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The Action of the Alkalies Upon Wool

Part I

A Review and Discussion of the Literature Upon the Action of the Various Alkalies Upon the Wool Fiber—"Dissolving" Wool in Alkaline Solutions—A Comparison of the Ionization and pH of Various Reagents—Comparison of the Various Reagents Used in Wool Scouring—Work of Matthews and Chapin

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WHILE the action of acids upon our textile fibers is of great interest to all those connected with the industry, the action of the alkalies is of even wider interest and importance, in that it is practically impossible to manufacture and use any textile product without washing it either during the process of manufacture or when in use, usually both, and every washing operation is an alkaline process.

The deleterious action of the alkalies, especially the caustic alkalies and probably all others in proportion as they are dissociated in solution to form free hydroxyl groups, is well known to all those connected with the industry, and the author hopes that all readers will agree with him that this injury is strictly chemical and is controlled by the hydrogen (or hydroxyl) ion concentration, temperature, and time of contact with the solution. This is very nicely shown by the work of Merrill, Chapin and others, which follows.

The action of the alkalies upon the physical properties of the wool, such as handle, feel, appearance, color, etc., is well known. When in dilute solution, at low temperatures, the action is not great, but as the concentration is increased the injury is also increased. This is very apparent upon drying wool or woolen materials containing an alkaline solution. While the dilute solution itself may not damage the fiber appreciably, on drying it on the fiber, with the consequent concentration of alkali, the action on the fiber of the hot and more concentrated alkali is very much greater than that of the original solution and usually results in considerable damage to the valuable properties of the fiber.

Many years ago Chevreul showed that lime water and other alkaline solutions removed sulphur from the wool molecule,* and it now appears very probable that in alkaline solution the wool molecule has an enol form of structure, while on the acid side of the isoelectric point the keratin molecule has the keto form.† The sulphur removed by the alkali appears in solution as the sulphide of the alkali. Bowman, *J. Soc. Dyers and Colourists 1,* 139 (1885), states that the sulphur cannot be completely removed from wool by alkaline solutions except by boiling, when the fiber is completely disintegrated, but it is well known that some change takes place in alkaline solution which permanently alters the properties of the fiber as regards to dyeing, resistance to acids, etc.

The discoloration or browning of wool containing even very small amounts of alkali on drying or heating is also well known to all those engaged in the industry, and has been shown by Chapin, in a paper discussed in this installment, to be largely a function of the hydroxyl ion concentration, time and temperature being the other two important factors. The effect of heat will be considered in detail in a later paper.

"Dissolving Wool"

When wool "dissolves" in an alkaline solution, it is not a simple solution of the keratin substance in the aqueous alkaline solvent, such as would occur on dissolving a neutral inorganic or organic salt in water. The alkali reacts first with the free carboxyl groups of the keratin molecule and then, if sufficiently concentrated, appears to attack the amino acid linkages of the protein molecules. In the case of the peptide linkage, where the amino groups are bound together by CO.HN groups, the alkaline hydroxide, either present as such in the solution or formed by the hydrolysis of the alkaline salt, appears to

*See American Dyestuff Reporter 15, 501-502 (1926).

†See American Dyestuff Reporter 15, 536 and 571 (1926).

attack this linkage, with the consequent hydrolysis of the protein, probably according to the equation:

$$X—CO.HN—Y + NaOH = X—COONa + Y—NH_2.$$

This is, of course, in addition to the simultaneous formation of alkaline sulphides by the alkali with sulphur from the keratin. Therefore, it is not a matter of dissolving the wool at all. It is strictly a hydrolysis of the protein molecule and a solution of the alkali proteinates formed by this hydrolysis.

As the extent of this hydrolytic action is entirely dependent upon the hydrogen ion concentration of the solution, all other factors remaining constant, and the so-called "mild" alkalies are dissociated in aqueous solution to a much smaller extent than the hydroxides, etc., it naturally follows that the alkaline salts, or the mild alkalies, such as sodium or potassium bicarbonates or borate or even ammonium carbonate, have a much less deleterious or hydrolytic action on the wool than the corresponding alkaline hydroxides or other "stronger" alkalies. The extent of the injury is practically solely dependent upon three factors: the hydroxyl ion concentration of the solution, the time, and the temperature; or all other factors being constant, upon the hydrogen (or hydroxyl) ion concentration of the solution alone. Of course, the previous history or treatment of the protein also influences the extent of the reaction, but this is an independent factor in all cases. Table XLVIII is of interest in this connection in that it gives the hydrogen ion concentration of equivalent solutions of sodium and ammonium hydroxides. Table XLIX gives the ionization and pH values of solutions of sodium and potassium hydroxides, while Table L gives the same for ammonium and barium hydroxides. These two latter tables are abbreviated from "Van Nostrand's Chemical Annual," 6th edition (1926), pages 82 and 83.

TABLE XLVIII

Hydrogen Ion Concentration of Sodium and Ammonium Hydroxide Solutions of Various Strengths.

Concentration (normality)	pH of NaOH	pH of NH_4OH
1.0 normal	14.05	11.77
0.1 normal	13.07	11.27
0.01 normal	12.12	10.71
0.001 normal	11.13	10.27

Dr. *Knecht, J. Soc. Dyers and Colourists 5, 72* (1889), in discussing the amount of alkali necessary to completely dissolve wool, states that after boiling wool for 3 hours in a solution containing 0.3% of sodium hydroxide, on the weight of the wool, the fiber was not entirely disintegrated. However, when the caustic was increased to 0.6%, complete disintegration and almost complete solution took place. As he does not give the volume of water in the bath, it is impossible to estimate the hydrogen ion concentration, or true activity of the solution used.

Harrison states that wool is appreciably tendered in an hour by a 0.04 per cent sodium hydroxide solution at 50° C. (122° F.), and that even at 20° C. (68° F.), any concentration of caustic above 1% rapidly deteriorates the fiber. Schofield says that it appears to be established that both sodium and potassium hydroxides have a direct chemical action on wool, removing sulphur from the keratin molecule and dissolving the fiber. In this connection

TABLE XLIX

Ionization and pH Value of Potassium and Sodium Hydroxide Solution of 25° C. (77° F.)

Moles of Base per Liter	Potassium Hydroxide: % Ionized	Potassium Hydroxide: Moles OH^- per L	Potassium Hydroxide: pH	Sodium Hydroxide: % Ionized	Sodium Hydroxide: Moles OH^- per L	Sodium Hydroxide: pH
2.000	66.3	1.326	14.12	57.0	1.140	14.06
1.000	81.9	0.819	13.91	76.6	0.766	13.88
0.800	84.3	0.759	13.83	79.2	0.634	13.80
0.600	86.3	0.518	13.71	81.9	0.491	13.69
0.500	87.6	0.438	13.64	83.5	0.418	13.62
0.400	88.8	0.355	13.55	85.3	0.341	13.53
0.200	92.2	0.184	13.26	89.8	0.180	13.26
0.100	95.0	0.095	12.98	92.9	0.093	12.97
0.080	95.8	0.077	12.89	93.7	0.075	12.88
0.060	96.7	0.058	12.76	94.7	0.057	12.76
0.040	97.9	0.039	12.59	96.0	0.038	12.58
0.020	99.3	0.020	12.30	97.9	0.020	12.30
0.010	99.9	0.010	12.00	99.5	0.010	12.00
0.008	100.0	0.008	11.90	99.9	0.008	11.90
0.006	100.0	0.006	11.78	100.0	0.006	11.78
0.004	100.0	0.004	11.60	100.0	0.004	11.60
0.002	100.0	0.002	11.30	100.0	0.002	11.30
0.001	100.0	0.001	11.00	100.0	0.001	11.00

the discussion of Farrell and Goldsmith's paper, which follows, is of interest, in that it gives a comparison of the hydroxyl ion concentration of sodium hydroxide and carbonate solutions.

Wool Scouring

Sodium carbonate is widely used in wool scouring, usually in the presence of soap, and the scoured wool frequently contains damaged fibers. In fact, the scouring process on raw wool is commonly regarded as a process which requires little skill or attention. However, as this is one of the initial operations in the process of manufacture, any damage during the scouring is cumulative throughout the whole process of manufacture, as will be shown later. For this reason it should be one of the most carefully controlled operations in the whole scheme of manufacture, and it is usually advisable to leave it in the hands of specialists in this line of work, when the very best results are desired. Too few manufacturers realize that damage which becomes apparent in the subsequent processes of manufacture may very often be due to incipient damage during the careless scouring of the raw wool. (Also see paper on wool damage, to follow in this series.)

Matthews' Experiments

One of the most complete and detailed studies of the effects of the various alkaline detergents upon wool yarn is that of Dr. J. M. Matthews, *J. Soc. Chem. Ind. 24*, 659-662 (1905.) The only criticism which could be made of this work is that all of the strength tests were made upon the yarn itself, and not upon the individual wool fibers. It is now well recognized, as shown by Dr. Chapin, American Dyestuff Reporter 14, 859 (1925), that the tensile strength tests made upon dry wool yarn, after treating in an alkaline solution, are quite in error as regards the effects of the alkaline treatment upon the individual wool fibers. Undoubtedly, the wet strength tests give much better, but probably not exact, results. While in 1905 the hydrogen ion concentration was an almost unrecognized factor in technical tests and discussions, these tests would have been of considerably more interest if this information had been included; however, we cannot criticise Dr. Matthews on this point.

It is well known that the scouring effect of soap combined with the various alkaline detergents is considerably greater than that of either alone. Therefore, a study of both the detergent and deleterious effects of such solutions would have been of great interest in connection with practical work. In order that the results of these experiments may be studied and compared more conveniently, the tables covering the different reagents will be grouped together in this case, along with the action of water alone on the fiber. On account of the completeness of this work and its practical importance, it is given here in rather more complete form than some of the other papers along the same line.

All of these tests were made upon a medium grade of woolen yarn. This yarn had been carded and spun with an emulsion containing lard oil and borax about six months before the experiments. In the unscoured condition it was of a grayish color and contained about 0.1% of iron. The grease and miscellaneous dirt content was about 6% (by solvent extraction and scouring). Five gram yarn samples containing 23 strands were used in the experiments, with 250 cubic centimeters of the re-

TABLE L

Ionization and pH Value of Ammonium and Barium Hydroxides at 25° C.

	Ammonium Hydroxide			Barium Hydroxide		
Moles of Base per Liter	% Ionized	Moles OH^- per L	pH	% Ionized	Moles OH^- per L	pH
2.000	0.30	0.00600	11.78			
1.000	0.42	0.00420	11.62			
0.800	0.47	0.00376	11.58			
0.600	0.55	0.00330	11.52			
0.400	0.67	0.00268	11.43			
0.200	0.94	0.00188	11.27			
0.100	1.33	0.00133	11.12			
0.080	1.49	0.00119	11.08			
0.060	1.72	0.00103	11.01			
0.040	2.12	0.00085	10.93	81.0	0.0320	12.51
0.020	2.96	0.00059	10.77	86.0	0.0170	12.23
0.010	4.15	0.00042	10.62	88.4	0.0090	11.95
0.008	4.62	0.00037	10.57	90.5	0.0070	11.85
0.006	5.33	0.00032	10.51	91.3	0.0055	11.74
0.004	6.48	0.00026	10.42	93.0	0.0037	11.57
0.002	8.99	0.00018	10.26	95.0	0.0019	11.28
0.001	12.52	0.00013	10.11	96.0	0.0010	11.00

spective solution, in a porcelain beaker, working by hand. After 20 minutes, the samples were washed well in fresh water, squeezed and dried. The loss in weight was determined on each skein, as well as the tensile strength and elasticity. The tensiled strength of the unscoured yarn was 28.5 pounds to the skein of 23 strands, or on five tests, a minimum of 28 pounds and a maximum of 30 pounds. The elasticity was 19%. Table LI shows the loss on treatment with water only at 60° C. (114° F.) and 100° C. (212° F.).

On scouring with neutral olive oil soap, 5 grams per liter, at 18° C. (65° F.), the loss in strength was about 5% more than with boiling water alone, although the elasticity was not affected. Table LII shows the results of this test, and it will be noticed that as the scouring temperature increases, so also does the loss in strength, although the elasticity is not affected below about 60° C. (140° F.), and even at boiling is not seriously altered. A complete scour, in this case, was not obtained below 60° C. It will be noticed that at temperatures above 18° C. (65° F.) all iron appears to be removed from the fiber. In this the action of the soap alone differs from that of the alkalies used in the accompanying tests, in that in each case with the alkalies, iron still remains in the fiber after each scour, regardless of the temperature. However, this is as would be expected.

Sodium Carbonate

The effect of sodium carbonate solution on the yarn was studied by means of two series of experiments, the one series at a constant temperature of 60° C. (140° F.) with varying amounts of carbonate, and the other with 5 grams of carbonate per liter at various temperatures. The scouring effect on the yarn with sodium carbonate alone was not particularly good and the luster of the fiber was considerably affected, especially at the higher temperatures, and with the stronger solutions. Where the alkali concentration and temperature were sufficiently high to give a good scour, the fiber was left in a lifeless condition and without resilience. The effect of the carbonate on the tensile strength is not apparent, due to the felting, shrinking and roughening effects of the alkali. As the concentration of alkali increases, these combined effects are sufficient to entirely counterbalance the loss of strength in the individual fibers, thus giving the yarn an apparent strength greater than at the lower concentrations. Table LIII gives the results at 60° C., and Table LIV at various temperatures. At temperatures above 60° C., with only 5 grams of sodium carbonate per liter, there is considerable deterioration, and at the boil the yarn is valueless for practical purposes.

Caustic Alkalies

Table LV, giving the effects of sodium hydroxide on woolen yarn, shows that whereas a solution containing 0.1 gram of hydroxide at 60° C. injures the wool to some extent, it does not scour the wool any better than water alone (see Table LI) at the same temperature. The effect of this hydroxide solution on the appearance and feel of the stock is very evident and shows deterioration at the temperature used. It appears from the experiments with sodium hydroxide alone, that in no case was the grease completely removed, and iron always remained in the stock. With 0.5 gram of sodium hydroxide per liter at 60° C. the strength of the yarn was damaged to the extent of being useless for manufacturing purposes. The remaining strength was largely due to a felting of the fibers. The elasticity was involved and the loss in weight shows a loss of fiber substance. Table LVI shows that at higher temperatures, even with 0.1 gram of sodium hydroxide per liter, the deterioration is very much greater than at lower temperatures.

Ammonia

Matthews believes that the results given in Table LVII show that ammonia alone is not so effective as a scouring agent as is commonly claimed in the literature and points out that at 60° C., only at a concentration of 10 c.c. per liter is the grease completely removed, while as shown in Table LII, 5 grams of soap per liter completely emulsifies and removes all of the dirt and grease. Furthermore, the ammonia appears to set the iron in the fiber, giving it a brownish tint, while the soap removes the iron and leaves the stock almost pure white. However, as shown in Table LVIII, ammonia does not appear to impair the strength of the yarn to a serious extent, except at higher temperatures. Also see Farrar and King.

Table LIX gives the effects of borax in various concentrations and indicates that alone this compound is not very effective as a scouring agent. Even 10 grams per liter does not give a complete scour, and Table LX indicates that 5 grams per liter does not completely remove all grease even at the boil.

(*Continued on page* 131)

TABLE LI

Effect of Hot Water on the Strength, Elasticity and Weight of Wool Yarn

Temperature °C.	Temperature °F.		Strength Pounds	Strength Loss in %	Elasticity %	Elasticity Loss in %	Loss in Weight, %
Original		.....	28.5	....	19	..	...
60	140	.....	28.5	37.0	19	0.	2.2
100	212	.....	18.2	36.0	19	0.	3.4

TABLE LII

Effect of Olive Oil Soap Solution, 5 Grams per Liter, on Wool Yarn

Temperature °C.	Temperature °F.	Strength Pounds	Strength Loss in %	Elasticity %	Elasticity Loss in %	Loss in Weight, %	Iron
18	65	16.8	41.	19.	0.	4.2	Yes
38	100	15.3	46.	19.	0.	4.5	None
60	140	12.6	55.	18.	5.	5.7	None
82	180	11.4	60.	17.	10.	5.6	None
100	212	10.8	62.	16.	15.	5.9	None

TABLE LIII

Effect of Sodium Carbonate Solutions at 60° C. (140° F.) on Wool Yarn

Grams Na_2CO_3 per liter	Strength Pounds	Strength Loss in %	Elasticity %	Elasticity Loss in %	Loss in Weight, %	Iron
1	12.5	56.0	19.0	0.0	4.0	Yes
2	13.6	53.0	19.0	0.0	4.3	Yes
3	15.8	45.0	19.0	0.0	4.4	Yes
5	14.1	50.0	19.0	0.0	4.8	Yes
10	17.4	39.0	18.0	5.0	5.3	Yes
15	18.0	37.0	17.0	10.0	5.6	Yes

TABLE LIV

Effect of Sodium Carbonate Solution, 5 Grams per Liter, at Various Temperatures on Wool Yarn

Temperature °C.	Temperature °F.	Strength Pounds	Strength Loss in %	Elasticity %	Elasticity Loss in %	Loss in Weight, %	Iron
60	140	14.1	50 0	16.0	16.0	4.8	Yes
82	180	13.0	54.0	16.0	16.0	5.1	Yes
100	212	11.6	59.0	11.0	44.0	6.0	Yes

TABLE LV

Effect of Sodium Hydroxide Solutions at 60° C. (140° F.) on Wool Yarn

Grams NaOH per liter	Strength Pounds	Strength Loss in %	Elasticity %	Elasticity Loss in %	Loss in Weight, %	Iron
0.1	16.1	43.0	17.0	10.0	2.0	Yes
0.2	15.3	46.0	14.0	26.0	2.2	Yes
0.5	12.4	56.0	11.0	44.0	8.7	Yes
1.0	8.9	70.0	10.0	49.0	12.6	Yes
2.0	4.0	85.0	9.0	52.0	18.5	Yes

TABLE LVI

Effect of Sodium Hydroxide Solution (0.1 Gram per Liter) at Various Temperatures on Wool Yarn

Temperature °C.	Temperature °F.	Strength Pounds	Strength Loss in %	Elasticity %	Elasticity Loss in %	Loss in Weight, %	Iron
60	140	16.1	43.0	17.0	10.0	2.0	Yes
82	180	7.8	72.0	11.0	44.0	13.2	Yes
100	212	...	100.0	....	100.0	100.0	...

TABLE LVII

Effect of Ammonium Hydroxide Solutions at 60° C. (140° F.) on Wool Yarn

Cubic Centimeters per liter	Strength		Elasticity		Loss in	
	Pounds	Loss in %	%	Loss in %	Weight, %	Iron
1	15.8	44.0	19.0	0.0	3.7	Yes
2	15.0	47.0	19.0	0.0	4.1	Yes
5	16.2	43.0	19.0	0.0	4.6	Yes
10	16.4	42.0	17.0	10.0	6.1	Yes
25	15.8	44.0	17.0	10.0	6.4	Yes

TABLE LVIII

Effect of Ammonium Hydroxide Solution (10 c.c. per Liter) at Various Temperatures on Wool Yarn

Temperature		Strength		Elasticity		Loss in	
°C.	°F.	Pounds	Loss in %	%	Loss in %	Weight, %	Iron
71	160	14.4	49.0	17.0	10.0	6.1	Yes
82	180	13.9	51.0	16.0	15.0	6.3	Yes

TABLE LIX

Effect of Borax Solutions at 60° C. (140° F.) on Wool Yarn

Grams per liter	Strength		Elasticity		Loss in	
	Pounds	Loss in %	%	Loss in %	Weight, %	Iron
1	14.0	51.0	17.0	10.0	4.4	Yes
5	16.6	42.0	17.0	10.0	4.3	Yes
10	16.2	43.0	18.0	5.0	4.8	Yes

TABLE LX

Effect of Borax Solution (5 Grams per Liter) at Various Temperatures on Wool Yarn

Temperature		Strength		Elasticity		Loss in	
°C.	°F.	Pounds	Loss in %	%	Loss in %	Weight, %	Iron
71	160	16.4	43.0	17.0	10.0	4.3	Yes
82	180	16.0	44.0	17.0	10.0	4.4	Yes
100	212	15.0	47.0	13.0	31.0	4.8	Yes

VAT DYES NOW PRODUCED BY LARGEST FRENCH COMPANY

One of the important developments in the French dyestuff industry recently reported is the manufacture of a range of vat dyes by the Kuhlmann company's Villers-Saint-Paul plant. The production of these new dyes is in line with the plan of expansion being followed by the Kuhlmann interests, and it is further reported, by Assistant Commercial Attache D. J. Reagan of Paris, that nine coal tar intermediates have been recently introduced into the trade by the firm. They include anthraquinone, the basis for alizarine and vat dyes, and beta-amino anthraquinone, the basis for solanthrene colors.

During the year 1927 the Kuhlmann Company announced the production of ninety-five new types of colors, forty of these being perfected at its plant at Oissel. Owing to the development by the French industry of such types as the bromo-indigo series and the solanthrene dyes, consumers have become independent of foreign sources in many important colors. Activity in the French industry of this character is regarded as especially significant in view of the recent cartel negotiations with Germany.

Directors of the American Association of Woolen and Worsted Manufacturers have unanimously approved plans for organization of a wool institute for the industry, resembling in its functions that maintained by the cotton manufacturers. President of the association, R. Leland Keeney, was given authority to appoint a committee of six to constitute a third of a larger committee of eighteen on permanent organization. Six others are to be appointed by the National Association of Wool Manufacturers and the remainder by other factors in the industry.

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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FIFTIETH COUNCIL MEETING

The fiftieth council meeting of the American Association of Textile Chemists and Colorists was held at the Engineers' Club, Boston, Mass., on Friday afternoon, February 3, 1928.

The following members were in attendance: E. H. Killheffer, W. S. Williams, L. A. Olney, G. A. Moran, H. Christison, W. M. Scott, W. R. Moorhouse, H. W. Leitch, Walter C. Durfee and W. E. Hadley.

The following applicants were admitted to membership:

Active Members

Armour, Bernard R., executive. Address: American Aniline Products Corporation, New York, N. Y.

Adler, John, dyer. Address: John Adler Piece Dye Works, Paterson, N. J.

Baker, Abel W., color mixer, Papyrus Company, Kennilworth, N. J. Address: R. D. 2, Box 462-C, Elizabeth, N. J.

Blair, Samuel, colorist, Imperial Printing & Finishing Corporation, Bellefont, R. I. Address: 76 Westwood Avenue, Edgewood, R. I.

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Earle, Richard Blair, chemist, U. S. Finishing Company. Address: 133 Power Street, Providence, R. I.

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Hummel, August, textile chemist. Address: H. & B. Textile Chemical Company, New York, N. Y.

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Krug, Karl, demonstrator and salesman, Du Pont, Philadelphia, Pa. Address: 2530 Filbert Street, Mt. Penn, Reading, Pa.

Kuhl; C. W., president and general manager, Carbic

Color & Chemical Company. Address: 451-453 Washington Street, New York, N. Y.

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Moertel, John C., textile chemist and colorist, Newport Chemical Works, Inc., Passaic, N. J. Address Ryeside Avenue, New Milford, N. J.

Morris, Frank J., colorist, American Aniline Products, Inc., New York, N. Y.

Pohlmann, Geo. C., dyer and chemist, 28 Mechanic Street. Address: Box 398, Keene, N. H.

Rioles, Paul A., dyer. Address: Cooper-Kenworthy, Inc., Providence, R. I.

Roux, Eugene M., dyer, Schwarzenbach-Huber Company. Address: Box 31, Union City, N. J.

Schwenn, Paul O., salesman and demonstrator, General Dyestuff Corporation, Providence, R. I. Address: 309 Point Street, Providence, R. I.

Wilson, G. Edwin, textile chemist, Boger & Crawford, Philadelphia, Pa. Address: R. F. D. Box 69A, Ellendale, Del.

Junior Members

Bannister, Robert E., chemist. Address: Hood Rubber Company, Watertown, Mass.

Bonner, James R., chemist, American Printing Company. Address: 396 Stetson Street, Fall River, Mass.

Carr, Frank A., head dyer, U. S. Dye Works, Inc. Address: 370 Buffalo Avenue, Paterson, N. J.

Carr, Kenneth L., textile chemist, Roessler & Hasslacher Chemical Company, Perth Amboy, N. J. Address: 21 Maple Avenue, Rahway, N. J.

Gaede, A. Henry, dyer. Address: Caledonian Dye, Philadelphia, Pa.

Kelly, Andrew, assistant chemist. Address: Burkart Schier Chemical Company, Chattanooga, Tenn.

Lipsius, Edward, Jr., laboratory assistant, Du Pont, Deepwater Point, N. J. Address: 12 Beach Avenue, Penns Grove, N. J.

Spengler, Carl J., student, Philadelphia Textile School, Philadelphia, Pa. Address: 1114 E. Columbia Avenue, Philadelphia, Pa.

Warner, E. Thomson, student, Philadelphia Textile School, Philadelphia, Pa. Address: 19 W. Oakdale Avenue, Glenside, Pa.

Corporate Members

American Aniline Products, Inc., George L. Armour, representative. Dyestuffs. Address: 45 E. Seventeenth Street, New York, N. Y.

American Thread Company, G. Ward Randall, representative. Thread manufacturing. Address: 260 West Broadway, New York, N. Y.

Sidney Blumenthal & Co., Inc., Harold H. Taylor, representative. Pile fabrics. Address: Shelton, Conn.

Borden & Remington Company, Heywood F. Lawton, representative. Dyestuffs and chemicals. Address: Fall River, Mass.

Carbic Color & Chemical Company, Inc., C. W. Kuhl, representative. Dyestuffs. Address: 451 Washington Street, New York, N. Y.

Dana Warp Mills, Luther Dana, representative. Cotton yarns. Address: Westbrook, Me.

Heyden Chemical Corporation, Geo. Simon and F. W. Weckman, representatives. Manufacturing chemicals. Address: 45 East Seventeenth Street, New York, N. Y.

A. Klipstein & Co., J. L. Schroeder, representative. Dyestuffs and chemicals. Address: 644 Greenwich Street, New York, N. Y.

Otis Company, J. W. Russell, representative. Cotton manufacturing. Address: 24 Milk Street, Boston, Mass.

G. Siegle Corporation of America, B. R. Armour, representative. Chemical manufacturing. Address: Rosebank, Staten Island, New York, N. Y.

The following members were transferred from Junior to Active Membership: James S. Massarene, J. Milton Washburn.

The proposed Amendments to the Constitution as passed to letter ballot at the Annual Meeting held December 3 and 4, 1927, were reported upon; 218 in favor and 1 opposed. Amendments were therefore accepted. These amendments were as follows:

Art. III., Par. 1: Strike out the last sentence "Such persons must, at the time of their election, be engaged in or directing work related to the application of dyestuff, or to bleaching, or to textile finishing."

Art. III, Par. 2: Add "and to hold office."

Art. III, Insert new paragraph between Par. 3 and Par. 4. "Associate members shall consist of persons who lack the qualifications of Active Membership but are interested in the objects of the Association."

Art. III, Par. 5: Strike out the first two lines and substitute "Applications for Active, Junior, Associate and Corporate Membership shall be transmitted in writing to the Secretary. Applications for Active and Junior Membership shall be accompanied."

Art. IV, The first sentence shall be changed to read, "At stated periods the Secretary shall mail to the members a list of all applicants for Active and Junior Membership, together with the names of the members who

certify to them, also a list of all applicants for Associate Membership."

Art. VIII, Par. 1: Change last sentence to read: "A retiring President shall also be a member of the Council for one year after the election of his successor, and the Chairman of the Local Sections, and the Chairman of the Research Committee, shall be members of the Council ex-officio."

Art. XIV, Par. 1: Change last sentence to read, "The Local Chairman shall become ex-officio a member of the Council of Association, and must be an Active Member."

The Secretary was instructed to communicate with several applicants and suggest that they make application for Associate Membership rather than Active Membership, which applications will be further considered at the next Council Meeting.

It was voted by the Council that members who resigned from the Association in good and regular standing, could, at any time, be re-instated by a payment of all back dues. In lieu of this, the former member would have to make out a new application blank.

Professor Olney reported that the Research Committee had held a meeting on January 20, 1928, which was well attended. The report is published elsewhere in the Proceedings.

The New York Section Committee of Arrangements on the Annual Meeting reported that all expenses incidental to the Annual Meeting, which amounted to approximately $2,200, were fully paid and the committee turned back to the Association a check for $76.67.

P. J. Wood was appointed Chairman of the Finance Committee, with Herman A. Metz and E. H. Killheffer as members of the committee. The Chairman will have the power to select such members of the Finance Committee as he may deem advisable.

The matter of handling the finances of the Association was taken up and it was decided that the interests of the Association would be better served by maintaining two entirely separate accounts; one covering the general receipts of moneys, and the other embodying those moneys derived from Corporate Memberships or other special subscriptions or contributions, which are to be devoted to the technical research work of the Association.

In view of the additional moneys which the Association hopes to handle in the future, the Council voted that the Treasurer should be bonded to the extent of $5,000, premiums on the bond to be paid by the Association out of the general treasury.

The Council voted that money received by the Secretary and forwarded to the Treasurer should be recorded, so that the Treasurer would receive a slip indicating the source of the money and the Secretary would retain stubs showing the transfer had been made.

It was voted that in the future the accounts of the Association should be audited once a year, and three members of the Association will be appointed by the President to act in this capacity.

Professor Olney was reappointed Chairman of the Research Committee.

The Committee on Prize Awards for the best papers published during the year 1928 consists of William H. Cady, chairman, W. S. Williams, Dr. Jos. F. X. Harold and Prof. E. C. Bertolet.

Mr. Durfee reported that quite a number of the members who had been dropped for non-payment of dues had made payment. He is to prepare a list of such members for the next meeting, at which time they will be re-instated.

A permanent Membership Committee was appointed, composed of the two Vice-Presidents and the Secretary. In order to conserve the time of the Council, it was decided that the qualifications of the applicants would be considered by the Committee, and only the names of such applicants whose qualifications fully met the requirements for Active Membership will be presented to the Council for election at the regular Council meetings. In such cases where there is insufficient information the application blank will be returned by the Membership Committee to the Chairman of the section from which the application came for his further action. Such further action can either be the supplying of additional information as to qualifications or the substitution of an application for Associate Membership where that seems to be called for.

The Secretary was instructed to prepare a suitable Associate Membership Blank, the form to be submitted to the President for approval.

The Secretary advised the Council that the Association had in reserve several complete sets of the AMERICAN DYESTUFF REPORTER, which have been collected since the inauguration of the Association, and it was the consensus of opinion that an advertisement should be placed in the Proceedings offering the yearly volumes at $5.00 per set.

Professor Olney was appointed Chairman of the Committee in charge of the publication of the 1928 Year Book, with power to appoint additional members of such committee.

From time to time requests have been received from different companies for the membership list of the Association with the object of circularizing the membership. Many of these concerns would make very desirable Corporate Members, and it was decided to

offer them the privilege of Corporate Membership which would give them all the benefits of the Association. In cases where such concerns did not care to avail themselves of the opportunity to become Corporate Members, it was suggested that a copy of the Year Book, containing the membership list, could be sold to such concerns.

The question of the sending out of the annual questionnaire was discussed and it was decided to separate entirely the questions relating to business connections and address of the member, putting these on the separate return postal card, so that the members could return them immediately upon receipt and not hold them until the entire questionnaire is filled out. It is hoped that in this way the names, occupations and addresses of members will be received in plenty of time so that the present inaccuracies in the membership list can all be corrected before the issuance of the next Year Book.

The Secretary was instructed to obtain information relative to machines for addressing envelopes and to ascertain whether a saving could not be made in this regard, over the regular typed envelope.

Mr. Durfee suggested that it might be well to subscribe to one of the systems which review the current technical literature. Professor Olney stated that such a plan was being followed at the Lowell Textile School with very satisfactory results. (Laid on table for the present.)

Dr. Killheffer felt that prior to the time when a regular campaign could be inaugurated for the raising of sufficient funds to carry out the contemplated work of the Research Committee, a very definite plan should be formulated covering the work which the Association hopes to accomplish, and with this in mind he offered the following for the consideration of the Council:

That a Technical Bureau be established containing the most modern and complete types of testing apparatus. Such a bureau should be under the control of a high-grade director with the necessary assistants, the Research Committee of the Association having supervision and regulatory powers over the bureau.

Such a bureau would be in a position to undertake special research problems of interest to the industry in general, as well as contracting for work for different corporations for a remuneration, which, if not at first sufficient to make a Technical Bureau self-supporting, would defray, to a great extent, the incidental expenses incurred in conducting same. Such a bureau would probably be self-supporting within a period of two years.

It was considered that certain textile associations, department stores, etc., would be glad to avail themselves of the opportunities offered by such a bureau. Such a bureau could act as umpire in different controversies which might arise. It would seem that this type of bureau would be best able to handle such work, and we should easily be able to command the respect of all organizations which require this character of work.

Mr. Williams suggested that it would be easily possible for such a bureau to grant certificates of approval on such material as met the requirements as laid down by the Association.

A close scrutiny could be made of current patent literature, with the object of protecting the industry in this regard.

The desirability of forming such a bureau is to be presented to the various Local Sections, in order to obtain a concensus of opinion.

It was voted to hold the next Council Meeting in New York on March 30, 1928.

WALTER E. HADLEY, *Secretary.*

FORTY-THIRD RESEARCH COMMITTEE MEETING

The forty-third meeting of the Research Committee was held at the Engineers' Club, Boston, Mass., on Friday, January 20, at 3 o'clock. The following members were in attendance: George A. Moran, Hugh Christison, Walter C. Durfee, William H. Cady, Philip F. Ripley, Hans Meyer, Howard D. Clayton, Russell W. Hook, Karl R. Moore and L. A. Olney. Telegrams expressing regret at being unable to attend were received from Edw. F. L. Lotte and Harold W. Leitch.

Chairman Louis A. Olney reported the progress that was being made toward international co-operation in the establishment of standard methods of dye testing.

Since January 12 communications have been forwarded to thirty-seven different members of foreign committees, together with the most recent reports of our various fastness committees. It was suggested that these reports be studied critically and that suggestions be returned in order that they might be given consideration in a revision of our methods which it is proposed to make previous to the publication of the 1928 Year Book.

The Chairmen of all Sub-Committees were urged to study their reports in the light of suggestions that have already been made, and also with the consideration in mind of international co-operation.

It was further suggested that additional types of fastness, such as fastness to rubbing, crocking, kier boiling, cross-dyeing, and perhaps others, should be worked out in order that the methods published in the next Year Book may be as complete as possible.

Reports of progress were made by William H. Cady, Chairman of the Sub-Committee on Light Fastness, and by George A. Moran, Chairman of the Sub-Committee on Fastness to Washing on Cotton.

At the present time a number of samples of printed fabrics and dyed cotton material are being subjected to a series of standard laundry treatments, and when these are completed the results will be studied in relation to the present Association tests for washing, with the object of correlating the results of the actual laundry tests with the laboratory methods.

The matter of a standard washing machine was discussed at length, and it was the opinion of the committee that the Chairmen of the various Sub-Committees on Fastness to Washing should formulate specifications for a standard type of laboratory washing machine for satisfactorily carrying out these tests. Two machines somewhat different in construction have been used by members of these committees and both have been found to give satisfactory and concordant results. In one case the jars containing the samples which were being subjected to the washing test were heated in an air bath and in the other machine in a water bath. The opinion was expressed that if either type of apparatus appeared to be more practical than the other, it should be adopted as the standard, rather than recommend two different types of machines. It was also proposed that when such standard specifications had been adopted a number of machines should be made and sold under the supervision of the Association.

List of Pre-War Dye Types

Progress was also reported in the endeavor to gather data for a complete list of pre-war prototypes of such dyes as have appeared in previous Year Books, but not assigned to any Schultz or Colour Index numbers. It was reported that there was every reason to believe such a list could be completed in time for publication in the 1928 Year Book.

The subject of the Findex System, described quite fully by Walter C. Durfee in the June 14, 1926, issue of the Proceedings, was brought up for further discussion. The opinion was expressed that this system might prove of value in connection with the Research Committee's program of eventually tabulating the fastness properties of dyes in accordance with the Association's Standard Methods. It was further stated that as many as one hundred different properties and degrees of fastness could be recorded in regard to each dyestuff, and that dyestuffs responding to any one of these properties or combination of properties could be automatically selected from the card index. Walter C. Durfee and Karl R. Moore were asked to co-operate further in preparing a questionnaire that could be sent to the members of the Association, in order that the requirements that might be demanded of such a system could be determined, and also to receive expressions of opinion as to its value and usefulness.

The matter of the so-called "sledded" or "Western" cotton which had been brought to the attention of the Research Committee by one of the members, with the request that it be given some publicity in the Proceedings of the Association, was discussed quite fully. Various phases of this subject are discussed in a communication which will be found directly following this report. The following subjects were discussed before the committee:

Colored mill crayons.

Immunized cotton for the production of white cotton selvages.

Practical trials of the comparative action of Potassium and Sodium Compounds upon wool, as a further development of Research Contribution No. 4, as pubpublished in the February 7, 1927, issue of the American Dyestuff Reporter, page 42 of the Proceedings.

The Investigation of Wool Oils.

The program of the Research Committee for 1928.

L. A. Olney, *Chairman.*

COMMUNICATION

"Sledded" or "Western" Cotton

The matter of sledded or western cotton apparently has caused much concern at times to dyers and finishers who have been obliged to handle cloth containing such cotton.

The matter has been brought to the attention of the Research Committee of the American Association of Textile Chemists and Colorists, with the request that they give certain phases of the subject some publicity. At a recent meeting of that committee the opinion was expressed that it would be well to ascertain the extent to which this type of cotton was being used under conditions that might lead to difficulties in dyeing and finishing.

Sledded cotton is so named because it has been gathered by the sledding method, which means that the entire cotton plant is uprooted by dragging a sled carrying projecting prongs down the rows of cotton plants, thus picking not only bolls but also the stalks and leaves. This is usually done when the bulk of the bolls, namely those near the bottom and center of the stalk, are ripe; but the mixture always contains some immature top bolls which are in a more or less unripe condition. This rather indiscriminate mixture is then threshed and given several extra ginning operations, but at the best a very leafy and specky fiber results, which not only has been seriously injured mechanically, but also contains a considerable

amount of unripe or so-called dead fiber which, from the dyer's point of view, is infinitely worse.

While this type of cotton has been studied more or less from the standpoint of spinning and weaving (see article by F. Gordon Cobb, April 26 issue of the Textile World), the fact has not been sufficiently emphasized that although such cotton might, by proper handling, be satisfactorily carded, spun and woven into cloth, various difficulties might still arise during the subsequent dyeing and finishing.

There has been, perhaps fortunately, a very short crop this year from the portions of Texas and Oklahoma from which "sledded" cotton most frequently comes, and as a result there may not be as much of this cotton in the market this year as there was last.

It is a fact, however, that the harvesting of cotton by this method is still popular, and if conditions another year are favorable for its extended use, there will undoubtedly be even more of this type of cotton on the market, and it is believed that if this method of harvesting cotton is to be persistently used, textile manufacturers should be advised not to use it in certain types of fabrics which must later be dyed and finished. A number of specific instances have recently been brought to our attention where it was practically impossible to obtain various shades and properly finish the goods. This has been particularly true of Sulphur Olive Drab, Sulphur Black and various dyeings of blue and brown.

The Research Committee specially requests that members of the Association or others communicate with the chairman in regard to this subject, particularly as to the extent to which this type of cotton is being used at the present time; the difficulties which arise during its use, and the methods used to prevent or correct them.

L. A. Olney, *Chairman Research Committee.*

JANUARY MEETING OF THE NEW YORK SECTION

The determination and control of hydrogen ion concentration was the subject so interestingly treated and discussed at the January meeting of the New York Section of the American Association of Textile Chemists and Colorists. The meeting was held as usual in the Machinery Club, New York, and was called to order after an informal dinner attended by thirty members. The total attendance was about fifty members.

The minutes of the previous meeting and the treasurer's report were read and approved. Announcement was made that the February meeting would be held in Paterson on the fourth Friday of the month. The chairman appointed a special committee consisting of Philip H. Stott and Charles Schaumann to arrange for the meeting place and other details.

Dr. Scott, who was to have opened the program, could not be present due to an unavoidable call out of town. The subject matter of his proposed talk was well covered by the two other speakers who graciously responded to the request to extend their papers to fill the unexpected gap.

The first paper was delivered by Dr. H. C. Chapin on the subject of the Electrical Method of Measuring and Automatically Controlling Chemical Concentration. This lecture was profusely illustrated with lantern slides and blackboard diagrams, as well as actual laboratory apparatus.

The second address was by F. R. McCrumb, who spoke on the Colorimetric Control of Hydrogen Ion Concentration. Mr. McCrumb presented the subject very thoroughly with the aid of blackboard work and specially prepared charts and actual laboratory demonstrations of colorimetric apparatus.

The meeting adjourned at about 10.45 p. m.

The chairman's introduction and the first paper follows:

Chairman Hayes—I have one announcement to make which I know you will all regret to hear. Dr. Walter Scott was to have talked to us to-night on "Hydrogen Ion Concentration—A New Tool in the Hands of the Textile Chemist," but he was unexpectedly called out of town.

However, we are fortunate in having with us Dr. H. C. Chapin, of the Lowell Textile School, who will speak to us on "Electrical Methods of Measuring and Automatically Controlling Chemical Concentrations."

Dr. Chapin! (Applause.)

. . . Dr. Chapin presented his prepared paper:

Electrical Methods of Measuring and Automatically Controlling Chemicals

By Dr. H. C. Chapin
Lowell Textile School

Electrical instruments have been so simplified externally that measurements of conductivity and pH require less experience than chemical analysis. Where such methods are applicable to routine control an unskilled worker or even an automatic machine can sometimes do the work of an analyst and apply the results. I wish to emphasize this simplicity of actual practice before going into principles of measurement and peculiar significance of pH.

Methods of two kinds are available. We may determine the power of a solution to assist or retard the passage of current from some external source, in other words, its conductivity or resistance; or we may make the solution part of an electric cell, and measure its power to produce current by determining the voltage of the cell.

Concentrations Measured by Conductivity

In water solutions the stronger acids and bases are excellent conductors of electricity, presumably because they dissociate into ions which act as carriers. For example, a molecule of hydrochloric acid dissociates into a positively charged hydrogen ion which moves toward the negative electrode carrying its portion of current, and a negatively charged chlorine ion which moves toward the positive electrode carrying its portion. Both really carry current in the same direction, because a positive charge carried one way is equivalent to a negative charge carried the other. The hydrogen ion does more than its share because it moves faster, so making more trips.

Thus all strong acids such as hydrochloric, sulphuric and nitric dissociate to a high degree, splitting off most of their hydrogen in the form of these rapidly conducting hydrogen ions, and corresponding amounts of remainder in the form of more slowly moving chloride ions, sulphate ions, nitrate ions, etc.

The strong alkalies, such as sodium and potassium hydroxides, dissociate in similar fashion, yielding slowly conducting metallic ions and rapidly conducting hydroxyl ions.

The weaker acids such as acetic, and the weaker bases such as ammonium hydroxide, dissociate but slightly, hence are very poor conductors. Water itself is dissociated to such a minute fraction of 1 per cent that it is practically a non-conductor.

All salts, even those from weak acids and bases such as ammonium acetate, are highly dissociated; but yielding only slowly moving ions they are not such good conductors as the strong acids and bases.

So it happens that by conductivity we can measure concentration of strong acid or alkali even in the presence of somewhat varying amounts of less conductive salts, while in the absence of strong acid or alkali we can measure the concentration of any salt or definite salt mixture.

Hydrogen Ion or pH Measurement, and Titration, by Voltage

In practice conductivity measurements are well supplemented by voltage measurements, through which are determined hydrogen ion concentrations and pH. In the very places where one method falls down the other often becomes useful. Thus in poorly conducting acetic acid solutions we can determine the low concentration of hydrogen ions yielded by the poorly dissociated acid. In this case hydrogen ion concentration is really what we want to know, because it represents the active portion of the acid. The remainder, serving only as a reserve, can be measured if necessary by a titration.

In titrations, as in all other work, electrical methods have the unique advantage of usefulness in highly colored or turbid solutions. While electrical titrations can sometimes be made by conductivity methods they are generally made by a series of pH or voltage measurements accompanying gradual addition of acid or alkali. The results give not only the end point, but also some indication of the substance titrated, whether the acid be strong mineral or weak vegetable, etc. Titration of oxidizing and reducing agents is even simpler.

In all water solutions the product of hydrogen and hydroxyl ion concentrations is the same, so that as one increases the other correspondingly decreases. Even in highly alkaline solutions there remains a minute hydrogen ion concentration, measurement of which determines indirectly the higher concentration of hydroxyl ions. So whether the solution be acid or alkaline we can express its activity in terms of hydrogen ion concentration, or more conveniently in terms of pH.

For all practical purposes we may consider pH values merely as points on a scale running from 0 to 14, with high acid activity at the bottom, neutrality at 7, and high alkali activity at the top. Thus pH rises as hydrogen ion concentration falls, and in such manner that each unit of pH represents one-tenth the hydrogen ion concentration of its predecessor.

Usually we may consider pH without regard to theory, simply as the measure of a desirable condition, irrespective of the particular chemicals producing it. Thus flour makes better bread when some characteristic of wheat gives a certain pH to the dough, or some unknown combination of impurities in a certain water supply makes filter alum floc best at a particular pH, or a dyeing comes to shade completely and evenly when with one chemical or another we hold the bath at some definite pH.

Choice of Instruments

Instruments for measuring conductivity and voltage can be understood more clearly in connection with Ohm's law, that in the simplest forms of electric circuit,

$$\text{Current, in amperes} = \frac{\text{Electromotive force or potential, in volts}}{\text{Resistance, in ohms.}}$$

or Current = Voltage $\times$ Conductivity.

Sometimes an ammeter, measuring current, is used for rough measurement of solution conductivity, on the ground that amount of current flowing is a measure of the solution's power to conduct, namely, its conductivity. But it is evident from the second equation that this can be true only when voltage is constant; and as it is difficult to keep voltage constant in such a circuit, the method is useless for accurate work. The standard method is by the Wheatstone bridge, an instrument which balances

known resistance or conductivity against unknown and so measures resistance or conductivity directly.

In an electrician's measurement of voltage it is usually convenient to keep resistance constant so that flow of current may serve as a measure of voltage driving current. Thus, for purely electrical measurements the so-called voltmeter, in reality a delicate ammeter, is generally satisfactory. In our electrochemical measurements it is not convenient to keep resistance constant. It is better, therefore, to employ a potentiometer, which measures voltage directly, balancing known voltage against unknown under conditions which admit no error from fluctuating resistance.

From old physics books you may remember bridge and potentiometer as cumbersome assemblies of laboratory apparatus. Now each comes wired together into one little portable instrument, ready for use anywhere and simpler to operate than a laboratory balance.

Despite the lack of outward resemblance each may indeed be compared with the chemist's balance, both in principle and operation. Instead of putting crucibles, etc., on a balance pan we connect conductivity cell or pH cell to labeled terminals. Instead of adjusting weights and rider we put a plug in the right hole and turn a dial on one instrument, or turn a dialed switch and dial on the other until a needle comes to zero. Then in the bridge, positions of plug and dial give resistance or conductivity, while in the potentiometer positions of switch and dial give voltage or pH. On the balance we can standardize one of our weights by putting a suitable standard weight on the opposite pan in place of the crucible. Likewise we first standardize our potentiometer by balancing a part of its voltage against a standard cell, contained within the instrument itself.

Wheatstone Bridge and Conductivity Cell

While knowledge of construction is unnecessary you may like to know a little more about the internal wiring of these instruments. In the Wheatstone Bridge diagram (a) represents a fixed resistance, (b) a graduated resistance with sliding contract, (c) an adjustable set of standard resistances, and (d) a conductivity cell dipping in the solution under examination. The resistance or conductivity measured is that of solution between the electrodes of this conductivity cell.

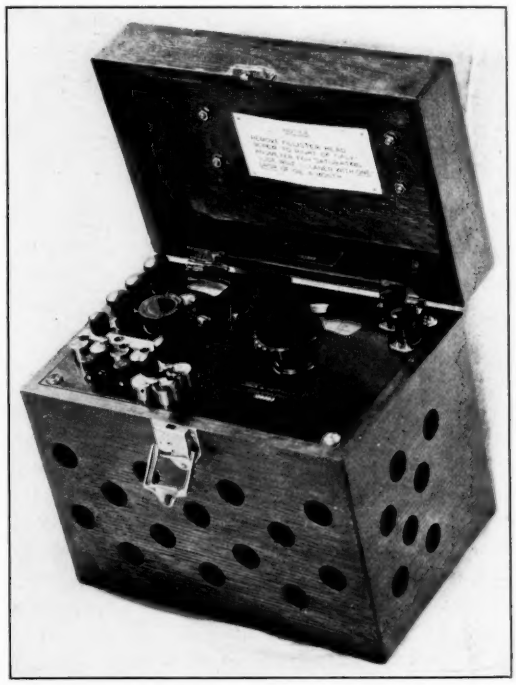
Across this circuit is bridged a source of alternating current lighting circuit as shown in diagram, or a device operated by dry cells. A transformer in the box protects against excessive voltage from the lighting system. Across the circuit at other points is bridged an alternating current galvanometer, or sometimes a telephone.

To measure the resistance of solution between electrodes of (d) we make rough adjustment at (c) and fine at (b) until galvanometer reads zero, indicating that no current leaks across in either direction. Resistances are then balanced that (a) : (b) = (c) : (d) or

$$(d) = \frac{(b) \times (c)}{(a)}$$

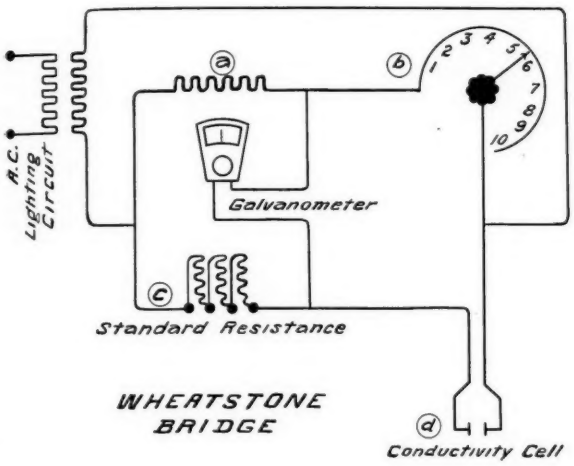
In the instrument illustrated allowance has been made for (a) in graduating (b) and (c), so we get solution resistance by just multiplying the reading (b) by some simple multiple of 10 obtained from position of plug at (c). We may calculate conductivity from resistance, or by shifting connections on the top of the box before starting measurements we may read conductivity directly from the instrument. Multiplying conductivity by a constant furnished with the cell we get "specific conductivity," a fundamental property of the solution, independent of bridge or cell used in measurement.

In recording instruments the same fundamental principle is employed. Each contains a small motor revolving at constant speed. Through ingenious but rugged mechanism this repeatedly adjusts a sliding resistance so as to keep the galvanometer needle at zero. In so doing it moves a pen against a slowly moving chart. This records conductivity of solution between electrodes to which the instrument is connected by wires of convenient length.



Wheatstone Bridge

Through relays such a recorder will serve as a controller as well, opening or closing valves, operating lights, etc., as solution conductivity departs from a desired value. Thus we automatically control dilution or concentration of a flowing solution so as to keep composition of product constant. Applications have been made in mercerizers to control sulphuric acid used in neutralizing excess caustic,



in power plants to measure accumulation of salts in boilers and leakage of condenser water in steam system, in sugar refineries to measure mineral content and evaporation of syrup, etc. Dilute caustic control is now being installed in a cotton finishing plant and other textile problems are under investigation.

Cell for pH Measurement

The potentiometer, used in pH measurement, balances known voltage against the unknown voltage of a cell dipping in the solution under examination. Such a cell contains the following parts in electrical series:

			hydrogen
saturated			electrode or
solution of			quinhydrone
potassium	saturated		electrode or
and	potassium	solution	tungsten
mercurous	chloride	under	electrode,
mercury	chlorides	solution	examination etc.

The mercury and mercurous chloride solution together constitute a "calomel electrode." The mercurous chloride, called calomel, is but slightly soluble and so appears in the electrode mostly as a white solid, the solubility of which is governed by the concentration of potassium chloride solution in which it is suspended. This may be normal, tenth normal or saturated, and the electrode is named accordingly. For all ordinary purposes it is saturated as indicated here.

The next solution in the chain is always saturated potassium chloride. This serves to connect the two electrode solutions, so is sometimes termed the "salt bridge."

The solution under examination may be in a beaker or in some form of flow channel drawing samples from a pipe or tank line. It is saturated with hydrogen, saturated with solid quinhydrone, or for the tungsten electrode is left untreated.

The hydrogen electrode is the fundamental standard for all these measurements. It consists of a platinum wire coated with platinum black and exposed to gaseous hydrogen. Usually hydrogen from a tank is passed through a tube surrounding the electrode and allowed to escape from the open bottom of this tube to form bubbles rising through the solution. This electrode is used principally for laboratory measurements, especially in highly alkaline solutions.

The quinhydrone electrode is a more recent development, simpler to operate and often more accurate than the hydrogen electrode. We have found it particularly useful in acid dye solutions. It works well in moderately alkaline solutions also, but as pH rises one must work rapidly to get accurate results. The metallic part is a plain gold or platinum wire. A trifling amount of quinhydrone serves to saturate the solution. This electrode is sufficiently simple and reliable for use in automatic controls.

The tungsten electrode may consist of just a tungsten wire dipping in the solution, but a little manganese sesquioxide in contact with the wire improves its efficiency. Certain peculiarities restrict its use to automatic measurement and control of pH in alkaline solutions. It is rarely employed with portable apparatus.

Many other types of electrode may be used for special purposes, some measuring other ions such as chlorine, etc. The same electrical instruments, if graduated in volts, may be used with these other electrodes.

For the sake of compactness and simplicity in operation the whole chemical system may be combined in one vessel as shown in the illustration. Mercury, calomel and saturated potassium chloride solution go into the glass compartment (B). From the bottom of this protrudes a tube with ground glass stopper (E) just tight enough to hold solution but pass electric current. Over this tube fits a porous earthenware thimble (F) full of saturated potassium chloride solution. Through a long tube (A) penetrating the cell goes a glass holder (C) for one of the various wire electrodes, and through this same tube may be passed hydrogen, entering at side arm near the top. The electrode holder is a fine glass tube with electrode sealed through its tip. A little mercury inside the holder makes contact between the electrode and a fine

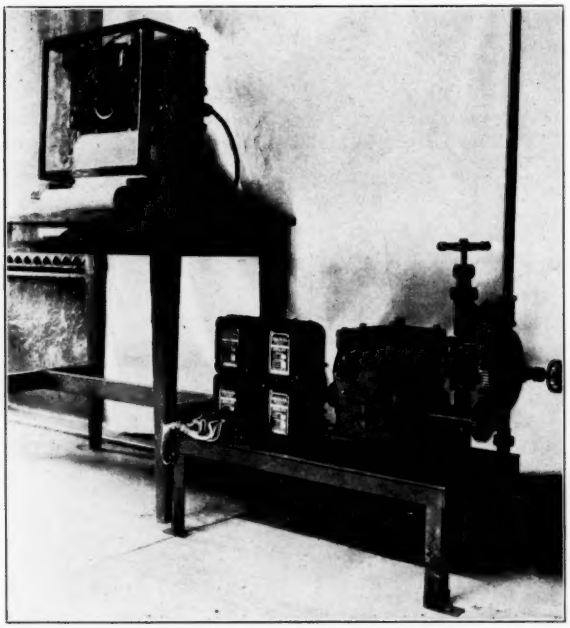
copper wire thrust in from the top. This wire goes to the potentiometer, as does also a wire (D) similarly connected with the mercury of the calomel compartment. The electric circuit is completed by dipping the projecting wire electrode and earthenware thimble into the solution under examination.

There is now on the market a complete portable kit containing in one box assembled for immediate use, potentiometer, cell, chemicals, tank of hydrogen, and all other essentials for pH determination by either hydrogen or quinhydrone electrode.

The Potentiometer

The potentiometer wiring diagram will appear simpler if we first cover the upper galvanometer and standard cell, also the lower galvanometer and pH cell. This leaves a circuit containing dry cell, two graduated resistances and rheostat. Around this circuit is dissipated the full voltage of the dry cell. We can dissipate as much of this as we please in the adjustable rheostat, leaving any desired voltage drop for the graduated system.

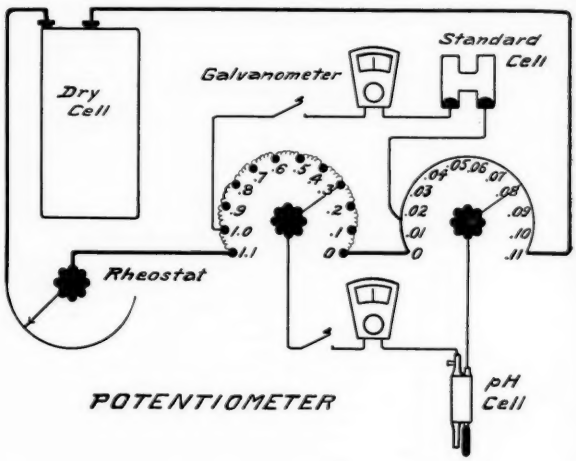
Between any two points in this system there will, of course, be a difference in voltage, so that if points be connected by a branch circuit, current from the main circuit will tend to split off through the branch. Thus when we close the little upper circuit, current tends to branch off through the standard and galvanometer.



Recording Potentiometer, Relays and Valve Connected with pH Cell and Automatically Controlling pH of Boiler Feed Water.

This standard is a little cell so connected that it opposes the branching tendency from the main circuit. Its voltage corresponds numerically with the points on the dials at which its circuit connects. If we make the main circuit voltage drop between these points just enough to balance the standard, then main circuit voltage also will correspond with the dials. This we accomplish by adjusting the rheostat until the galvanometer, in the standardizing circuit, reads zero.

Leaving the rheostat in this position we now disconnect the standardizing circuit and connect pH cell circuit with movable dial contacts. Then by moving these contacts we tap off just enough voltage drop to balance pH



cell voltage, or in other words enough to make the galvanometer, in this circuit, read zero.

In the instrument itself one galvanometer serves both standardizing and measuring circuits. The operator turns a switch one way, presses a button, and turns a knob on the side of the box; repeating this until the needle stays at zero. Then he turns switch the other way, presses button and gets rough adjustment on one scale, fine on another, to make needle stay again at zero. He may then read volts and calculate pH on a special slide rule, or he may read pH directly from potentiometer scales graduated in pH units.

Automatically recording potentiometers do by themselves all these things except standardizing, which requires but a moment's attention once a day. Connected with thermocouples they have been used for fifteen years measuring and recording high temperatures. Ninety-five per cent of our automobiles contain steel parts heat-treated under their control.

These same recording instruments, connected with pH cells, have been used successfully in acid or alkaline treatment of boiler feed waters, sugar syrups, city water, sewage, etc., a list limited by newness of application rather

pH Cell and Potentiometer Together

than possibilities. In many cases pH has been automatically controlled as well as recorded.

The question may be asked, "Why bother with such accurate control when textile operations are necessarily so variable at many points?"

In some cases saving in chemicals alone will soon pay for control, but this is a minor matter compared with possible improvement in product. Measurement of a variable in process and subsequent control at what experience proves the optimum point will never hurt a product. It may help in unexpected ways, not the least of which is fixing of responsibility for the smaller number of variables which remain uncontrolled. After a suitable routine has been developed under hand control it can be maintained more reliably and at less expense by automatic control.

A good measuring instrument differs from other mill equipment in that its value improves with use. By this I mean that as we compare records of many observations we find hidden relations between process and product. These give new meanings to all subsequent measurements and multiply their value.

REFERENCES

W. M. Clark"s "The Determination of Hydrogen Ions" (Williams & Wilkins Co., 1922) is the leading text on this subject. Since publication of the last edition considerable progress has been made in application of quinhydrone and tungsten electrodes.

Kolthoff & Furman's "Potentiometric Titrations" (John Wiley & Sons, 1926) describes a variety of analytical methods with various electrodes.

Conductivity methods are described in considerable detail in many general physical chemistry texts and laboratory manuals.

Among journal articles on special subjects the following have been selected as typifying application of electrical methods to textile problems or others of immediate interest to textile manufacturers:

Scott, Shelton & Grover, Am. Dyestuff Rep. 14, 862 (1925), show that amounts of certain dyes absorbed by silk from acid solutions are dependent on pH, regardless of the particular acid used.

H. C. Chapin, Am. Dyestuff Rep. 14, 859 (1925), and 16, 90 (1927), shows that alkali solutions weaken and discolor wool to a degree dependent on pH rather than nature or concentration of alkali; further, that wool has commensurate effect on alkali solutions, lowering their pH.

Parker, Greer & Barba, Am. Dyestuff Rep. 16, 49 (1927), describe one of several installations recording and automatically controlling acid concentration by the conductivity method. Here controlled addition of concentrated sulphuric acid keeps a bath at the 2.88% concentration desired for neutralized excess of mercerizing caustic in cotton yarns.

Parker & Baylis, J. Am. Water Works Assoc. 15, 22 (1926), describe an installation recording pH of water supply for the city of Baltimore.

Parker & Greer, J. Am. Water Works Assoc. 16, 602 (1926), describe a potentiometer installation in the Perth Amboy power house of the Public Service Electric & Gas Co. This records pH of boiler feed water and automatically maintains desired pH by addition of alkaline phosphate solution.

Henry C. Parker, Ind. & Eng. Chem. 19, 660 (1927), describes several forms of apparatus and their applications, among them an installation for treatment of sewage at Winston-Salem, N. C. This preserves desired pH in flowing sewage by automatically controlling addition of milk-of-lime.

Reprints of the last four papers can be obtained from Leeds & Northrup.

Discussion of the Electrical Method of Controlling Concentrations

Chairman Hayes—Are there any questions you would like to ask Dr. Chapin?

H. F. Herrmann—May I ask a question?

Dr. Chapin, you are undoubtedly acquainted with the so-called standing bath maintained in cotton dyehouses, say, for a color like Sulphur Black?

Dr. Chapin—Yes.

Mr. Herrmann—Which is being added to continuously, and then automatically certain substances are taken out?

Dr. Chapin—Yes.

Mr. Herrmann—The proper maintenance of a standing bath with respect to the sodium sulphide, salt, soda, ash, and things like that has been one of the bugbears of Sulphur Black dyeing. The gravity measure, as you know, is a very unsatisfactory one, because there are certain salts introduced from frequent replenishments with dyestuff, interaction of certain chemicals, possible impurities in the yarn. Is it possible, with a machine

such as you have been speaking of, to control the sulphide concentration?

Dr. Chapin—I should feel more enthusiastic about controlling the alkali concentration.

Mr. Herrmann—The total alkali?

Dr. Chapin—That or pH.

I have done no work on it, being more interested in wool and acid dye baths. We did some work last summer on a dye which is marketed under one Schultz number, but which comes as free acid, sodium salt, or zinc salt. That dye behaves very differently, according to its nature. We were able to distinguish these differences by pH measurements with quinhydrone electrode, and I think that eventually we shall be able to control the baths more satisfactorily. We haven't tackled the sulphur dye bath simply because we haven't had time.

Mr. Herrmann—But the distinction, you believe, between the alkalinity derived from sodium sulphide and from soda ash would be a rather difficult one to make?

Dr. Chapin—Yes; though many ions besides hydrogen and hydroxyl can be measured directly by electrical methods. It is not difficult to measure chlorine ions. But all these things are special problems, and we have not yet played with this particular sulphide bath.

Mr. Blake—I imagine I can answer Mr. Herrmann a little better than Dr. Chapin did.

There is another thing which enters in there and that is reduction. Sodium sulphide is a reducing agent. For that reason you cannot use a hydrogen ion instrument such as Dr. Chapin is describing. You get a reduction there which counteracts a lot of effects of the hydrogen ion. You have to watch out for certain things like that, which would make it almost impossible in the present condition to use this particular type of instrument. You might measure your hydrogen sulphide by using an instrument which gives you oxidation and reduction potentials. That sort of thing would possibly have better results than the straight hydrogen ion instrument.

Dr. Chapin—For oxidation and reduction potentials you do use the same potentiometer, but with it a plain platinum electrode, instead of the platinized electrode and hydrogen. Another dye bath more strongly reducing than the sulphide bath is the hydrosulphite, used for vat colors. I discussed this to-day with Dr. Parker of the Leeds & Northrup laboratory, who suggested a method worth trying for measurement of pH.

Chairman Hayes—Are there any further questions for Dr. Chapin?

I was interested, Dr. Chapin, to hear that you can measure chlorine in that way. Can you determine the available chlorine in a sodium hypochlorite solution, for example?

Dr. Chapin—I referred to chlorine ions from chlorides.

Chairman Hayes—You also spoke of the oxidation.

Mr. Blake—That is a different matter.

Dr. Chapin—We are interested in measuring and controlling hypochlorite solutions. I talked to chemists in many cotton finishing plants last summer. To all control of available chlorine seemed to be the subject most interesting. We hope to do something with potentiometric control.

Chairman Hayes—That has not been developed?

Dr. Chapin—No.

Chairman Hayes—One more question: You spoke of the effect of borax as lessening the effect of caustic soda on wool. Does that same thing apply, for example, to acid on cotton? Could you lessen the action of sulphuric acid on cotton by weaker acids, in the same way?

Dr. Chapin—Not by a weaker acid, but by the sodium or potassium salt of a weak acid. You know the effect of sodium acetate on a hydrochloric acid solution.

Chairman Hayes—Are there any other questions for Dr. Chapin?

From what Dr. Chapin said, it seems to me that any good operator of a radio set could determine hydrogen ions. (Laughter.) However, there is a second way of determining them and that is by the colorimetric method. We have with us to-night Mr. F. R. McCrumb, Chief Chemist of the La Motte Chemical Products Company, who will take up the "Colorimetric Control of Hydrogen Ion Concentration." (Applause.)

. . . Mr. McCrumb presented his prepared paper, which will be published in full in the next issue of the Proceedings.

Applications for Membership

Active Membership

Stehle, Chas. G., dyer, Brehme & Stehle Dye House, Frankford, Philadelphia, Pa. Sponsors: R. H. Brehme and P. Theel.

Kopf, John W., district manager, Newport Chemical Works, Inc., Chicago, Ill. Sponsors: E. H. Killheffer and C. F. Schaumann.

Stevenot, George A., chemist and proprietor, George A. Stevenot & Co., Brooklyn, N. Y. Sponsors: A. L. Benkert and F. P. Summers.

Walter, Howard A., teacher, Philadelphia Textile School, Philadelphia, Pa. Sponsors: E. C. Bertolet and P. Theel.

Parker, Samuel I., assistant superintendent, Proximity Print Works, Greensboro, N. C. Sponsor: H. A. Barnes.

Acker, Frank J., demonstrator-salesman, National Aniline & Chemical Company, Chicago, Ill. Sponsors: Carl Braun and James Hyde.

Sprock, Howard M., demonstrating salesman, Geigy Company, Inc., New York City, N. Y. Sponsors: Arthur F. Wiehl and D. P. Knowland.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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ATOMS THAT BECOME MOUNTAINS

THE scientist, like the detective story sleuth, has learned the importance of the unimportant, the significance of the insignificant. Experts in all highly technical fields, indeed, are trained to discern the relation of remote facts and details to the main line of investigation. The old schoolroom piece about the loss of the nail from the horse's shoe that led to the loss of a battle comes to mind as a well-known illustration of the disaster sometimes caused by the neglect of even one small detail. In scientific research atoms sometimes assume the importance of mountains.

The mind trained to follow a broad plan of action or to perceive at a glance the far-flung boundaries of a subject without losing respect for the minor divisions and their myriad details, is usually the type of mind that reaches startling conclusions by the very simple process of putting two and two together. Conclusions that amaze the world at first seem logical and very obvious when once established, but it took the right kind of mind to put the *right* two and two together. It is the type of mind that is entrusted with the responsibility of mapping out research programs. It is the type of mind that always supervises the detail workers—those who have their noses so close to their test tubes that they could never in all the world perceive the relation between that calculation on a cellulose mixture they worked out last week, for example, and the discovery of a new synthetic fiber.

Where is the laboratory assistant who has not, at times, grown exasperated over the apparent triviality of some of the jobs allotted to him by his chief? Perhaps he has even felt that much of the petty testing work in his routine is merely his chief's method of giving the laboratory that appearance of continual activity which is so satisfying to modern executives. He impatiently awaits the day when he will be able to hold down the chief's desk by assigning to a corps of assistants tasks without apparent purpose. He is blind to the significance of the insignificant. At such a time of life he is as unimaginative as the practically minded layman, who shakes his head over the queer way some scientists spend their lives jiggling bits of hair in the flame of a Bunsen burner or soaking samples of underwear cloth in a solution of naphtha soap. Where there is no perception of the "horse-shoe nail" details that decide battles, not only are battles lost but nothing great is ever won.

An apt example of the triumph of trifles in scientific research came to light recently in some of the tests carried out during the laboratory study of dye fastness. In establishing standards of fastness to light, not only are fabrics studied under glass of various kinds and exposed to various types of illumination, as is well known, but extensive calculations are made on the relation of weather conditions in various localities to the fading action of colors. A factor found to exert a marked effect on fading is humidity, and accordingly its variations in different parts of the world will be carefully determined by the trained investigator; for he discerns the relation of this one factor not only to his system of fastness standards, but also to something far more important from a practical standpoint. What this larger consideration is becomes clear when we learn that an accurate knowledge of the effect of sunshine in air of varying humidities will enable a mill to prepare fabrics especially to withstand fading in, say, India or California. For this fading data, it is obvious, will lead to the classification of dyes according to their action in different parts of the world, and consequently to improvement in the fastness of goods prepared for overseas consumption. Explain this relation to the layman whose mind thinks in terms of trade, and he will immediately understand how those laboratory tests for humidity may determine the popularity of American textiles in foreign markets. How significant some details are!

SIDETRACKED

WHEN the standardization of color fastness was first proposed, many in the textile industry realized that several years of educational publicity would be necessary before the scheme would work smoothly and to the benefit of everyone concerned. A uniform system of standards and tests would have to be established by the mills and this would then require translation into merchandising terms if it was to be of any practical use to converters, retailers and the ultimate consumer.

Something happened, however, that probably very few anticipated. The idea of fixing standards for colored fabrics was pounced upon by various textile trade groups besides those representing the mills, and was enthusiastically hailed in some quarters as a pro-

ject holding out many attractive possibilities. This hearty response was encouraging to the technical men, who perceived that in fast color standardization lay a solution to problems that have been vexing the textile trade for years.

Among these groups who found fastness standardization of sufficient interest to deserve serious study was the Converters' Association. A Committee on Misbranding was formed by the association, and its very first act was to stir up interest among allied groups in the practical definition of color fastness. The co-operation of the A. A. T. C. C. and the Bureau of Standards was enlisted in setting up tentative tests and standards. A lively and encouraging interest in the subject was developed at the meetings of this committee, which were attended by representatives of trade associations in many different branches of the textile industry. Both the Federal Trade Commission and the Better Business Bureau sent spokesmen to these meetings. A report on progress that embodied the tentative fastness tests was accepted more than a year ago, and it was agreed at that time that a decision on the final adoption of those standards would be made after members of the committee had given them further study.

So far so good. It is to be regretted, however, that many months have passed without an announcement by the Committee on Misbranding regarding its plans for establishing a workable system of fastness standards that can be adopted and used by converters, retailers and others. Interest in the project will need to be reawakened among the converters. What promised to be a movement of far-reaching educational value in the cause of fast color standardization has apparently been interrupted by more pressing matters.

CENTRALIZING A NATION'S RESOURCES

The Imperial Chemical Industries, Ltd., Great Britain's chemical trust, has opened negotiations with the Elliot Metal Company, according to a report from the Department of Commerce, with the evident intention of acquiring control of that firm. The news serves to call attention once more to the strategic position which the I. C. I. has already attained not only in the industry of the Empire but also in the industrial kingdom of all Europe.

The I. C. I. is termed a chemical trust but, through the diverse enterprises of its four major units, it has fastened a tentacle (and we use the term without intending any implications) upon some of the industries that form the foundation stones of a nation's welfare. Chemicals are, of course, a basic, essential commodity in modern industry. Mines and railroads are basic utilities; the United Alkali Company, one of the largest I. C. I. units, owns railroads and mines in Spain and produces innumerable chemical products consumed by other subsidiaries of the parent corporation. Explosives are essential in mining, railroading and all construction work; the Nobel Industries, Ltd., another constituent of the I. C. I., controls, among numerous related enterprises, the Nobel's Explosive Company, Ltd. Rubber is a basic material of modern transportation; Nobel Industries also has large holdings in the Dunlop Rubber Company, Ltd., as well as in General Motors Corporation. The annexation of the Elliot Metal Company, therefore, will give the I. C. I. facilities for producing still another basic commodity.

The position of the Imperial Chemical Industries, Ltd., in the textile field became a commanding one when the British Dyestuffs Corporation joined the combination. Recent increases in its capitalization are explained by the rumor-mongers with the news, as yet unverified, that the great British trust plans to acquire the Bradford Dyers' Association. Supposing this to be true—though there is no evidence to support such a supposition—it would provide an important outlet for the dye products of the consolidation and also make dependent upon the I. C. I. a large portion of the British textile industry.

Above the much-vaunted power of the old-time steel trusts and oil trusts and coal trusts there has risen that omnipotent giant, the modern "chemical" trust.

PATRON SAINT OF CHEMISTRY

(*An Editorial from the Ladies' Home Journal*)

DRESSING for a dinner party, she slips on her dainty undergarments made of cornstalks. Her sheer and silken stockings are of wood pulp, and her shoes are fashioned in the latest vogue from artificial skins. Her pretty frock was once part of a forest tree, and the gayly colored buttons with which it is trimmed were at some not far distant date the milk of contented cows. That afternoon the hairdresser had touched her curls with a synthetic sheen, and on her face she dabs a bit of the product of a dyestuff company. The rings on her fingers gleam with synthetic stones; her bracelets found their rich color in a chemist's crucible.

In a car painted with cotton she rides to her friends' home, and in a dining room whose walls are made of sugar cane the dinner begins with a grapefruit ripened by ethylene gas and ends with ice cream kept cold since early morning by the dry ice of carbonic acid gas.

No wonder a British chemist has dubbed the modern girl the "patron saint of chemistry." When W. S. Gilbert sang that "things are seldom what they seem, skim milk masquerades as cream" he didn't know the half of it, for milk to-day passes itself off for ivory or amber at the maker's whim. And every year adds to the number of inconceivable products made from incomprehensive beginnings.

The first cotton factory in the world to carry on in one establishment all the processes involved in the manufacture of goods from the raw material to the finished product was that established by Francis C. Lowell in 1815.

EXTRACTORIALS

The testing department of a manufacturing firm should be as vital a department as is the chemical laboratory of the artificial silk spinning plant. In this department the finger of the person in charge should be continually on the pulse of the firm's production. The department should be the center from which at any time correct information may be obtained regarding any of the goods in course of manufacture. Not only current information should be available, but data should be available on previous work going through; there should be such complete records kept as to allow of comparisons being made at any time between different lots of materials handled.—*F. W. Fearnsides, in the Textile Argus.*

There are three technical problems in the present standards of textile production that give the dry-cleaner endless worry in sales and no little expense in the costs of production. These problems are color, shrinkage of fabrics and adulteration of silk. Up to this time nothing has been discovered to clear these problems from the deck of the maintenance industries.—*Frank Stutz, in the National Association of Dyers' and Cleaners' Review.*

There has long been a feeling, in certain quarters at least, that educational institutions should confine themselves strictly to "pure" research and leave problems involving marketable ideas to be developed by commercial organizations. It is altogether right and proper that we should look to our university laboratories to uphold the torch of "pure" science. With few notable exceptions they are the sole seekers of truth, without reference to immediate application or personal gain. One could not view, save with regret, any disposition on their part to abandon a task which they have so faithfully and ably discharged in the past. On the other hand . . . it is entirely possible to maintain an upright attitude without leaning to rearward. A spirit of fidelity to "pure" science need not imply a conviction that some taint attaches to applied research.—*Editorial, Journal of Chemical Education.*

The spirit of science invites us all to seek for new knowledge, to collect it and to find ways and means of using it. It makes us attempt to define what we shall think and do. It encourages each one of us to make use of the special capacities we possess, not only for our own advancement, but also for the common good of the textile industry with which we have the honor to be associated.—*Henry Binns, before the Yorkshire Section of the Textile Institute.*

Chemicals have been aptly called the raw materials of raw materials. They are key units in the production processes of many industries, although their identity may often be entirely lost in the finished products. They serve to weld together as an indivisible whole the great group of chemical consuming industries.—*Chemical and Metallurgical Engineering.*

To bring about the conditions necessary to the future prosperity of American industry there must be co-operation and concentration of purpose. This means there must be proper organization. Not organization merely in groups of the same industries, but as industries unclassified. Let the groups take care of their group problems and let the central organization concentrate on those things which industry requires as a whole. . . .—*Editorial, Houghton's Black and White.*

The last few years have seen most revolutionary changes through chemistry in industry, but most of them are very old chemical ideas. All of them have long been forecast in chemical patent literature; some of them have rested for years dusty and forgotten on laboratory shelves; others have been peddled up and down industry's highways and byways by hopeful inventors.—*Editorial, Chemical Markets.*

For several years now at the annual meetings of the Colour Users' Association I have urged the vital importance of fundamental research and co-operation with the universities, which might be lost sight of in the competitive field. . . . There has been no definite organization to bring manufacturers of dyestuffs and intermediates into touch with the work carried on in our university laboratories. It is, therefore, gratifying to me to notice from the press that Sir Alfred Mond is taking steps to establish a closer liaison between the great technical industries of which he is the head and the universities, by means of an influential committee of experts.—*H. Sutcliffe Smith, of the British Colour Users' Association, in Chemical Age.*

There are mill men who are not so engrossed in golf, or in the immediate affairs of their plants as to be heedless of the future. They are like the people who are charged with national defenses—they believe not only in preparedness, but work to compass it by research and production. The managers are loath to be led; hence they essay leadership through originality or improvement. —*Editorial, The Textile Review.*

The buying public willingly pays a premium for imported wares. The particular commodity may possess less merit than a corresponding domestic one, but the fact that it is imported becomes impressive. Regardless of quality, the average buyer usually treasures foreign things more than those originating at home.—*Eugene Van Cleef, in The Industrial Digest.*

SUMMARY OF DYE AND COAL-TAR CHEMICAL IMPORTS FOR 1927

THE imports of coal-tar dyes during 1927 (preliminary figures) were 4,182,026 pounds, with an invoice values of $3,423,918. This represents a decrease of 491,170 pounds, or 11 per cent, and of $679,393, or 17 per cent less than that of 1926.

Table No. 1 shows the imports of coal-tar dyes for 1927 and for the years 1920 to 1926, together with the imports for the fiscal year 1914. The quantity for the year 1914 was taken from Department of Commerce, Special Agent Series 121, and the value from Commerce and Navigation. The figures for the years 1920 to 1926, inclusive, were taken from the Annual Census of Dyes and Other Synthetic Organic Chemicals, published by the United States Tariff Commission. The final figures for the dye imports of 1927 will be published in the Census of Dyes and Other Synthetic Organic Chemicals for that year.

TABLE NO. 1—COAL-TAR DYES: IMPORTS OF 1920-1927, AND 1914.

Year	Pounds	Value
1927*	4,182,026	$3,423,918
1926	4,673,196	4,103,301
1925	5,209,601	4,637,240
1924	3,022,539	2,908,778
1923	3,098,193	3,151,363
1922	3,982,631	5,243,257
1921	4,252,911	5,156,779
1920	3,402,582	5,763,437
1914	45,950,895	9,502,714

*Preliminary figures.

Table No. 2 shows imports of coal-tar chemicals and of color lakes for 1927 and 1926.

TABLE NO. 2—COAL-TAR CHEMICALS OF 1927 AND 1926

	1927	
	Pounds	Value
Synthetic aromatic chemicals	156,141	$193,583
Medicinals, photographic developers, intermediates, and other coal-tar chemicals	1,983,465	811,900
Color lakes	26,038	15,775
	1926	
	Pounds	Value
Synthetic aromatic chemicals	152,212	$191,232
Medicinals, photographic developers, intermediates, and other coal-tar chemicals	1,576,314	704,486
Color lakes	20,722	13,637

Table No. 3 is a summary of the dyes imported in 1927 and 1926, classified according to method of application. There is also shown the percentage of the total imports for each class of dyes for these two years. With the exception of the colar-lake and spirit-soluble dyes, which recorded an increase in 1927, there was a small decrease in the imports of each class of dyes. The proportion that each class made of the total imports shows small variation for the two years:

TABLE NO. 3—DYES: IMPORTS INTO THE UNITED STATES, CLASSIFIED BY METHOD OF APPLICATION, 1926 AND 1927.

	1927	
	Pounds	% of Total
Acid Dyes	652,981	15.61
Vat dyes	1,720,721	41.14
Mordant and chrome dyes	490,260	11.72
Direct dyes	721,307	17.25
Sulphur dyes	137,864	3.30
Basic dyes	333,246	7.97
Spirit-soluble and color-lake dyes	125,647*	3.01
Unidentified, unclassified special dyes	.....	....
Total	4,182,026	100.00
	1926	
	Pounds	% of Total
Acid dyes	793,855	16.99
Vat dyes	1,848,014	39.55
Mordant and chrome dyes	500,004	10.70
Direct dyes	805,848	17.24
Sulphur dyes	149,723	3.20
Basic dyes	406,732	8.70
Spirit-soluble and color-lake dyes	86,106	1.84
Unidentified, unclassified special dyes	82,914	1.78
Total	4,673,196	100.00

*Includes unidentified and special.

GERMAN DYES FORM LARGE SHARE OF INDIA'S IMPORTS

The considerable increase in imports into India of dyeing substances was due to arrangements made by German firms for direct importation into Madras, instead of through Bombay, as has been done in previous years. Imports increased from 2,689,000 rupees in 1925-1926, to 3,962,000 rupees of 1926-1927, according to advice from Consul E. B. Montgomery of Madras.

The arrivals from the Netherlands and Belgium are of German origin, representing shipments from Rotterdam and Antwerp of cargo water-borne on the Rhine. Alizarine and aniline dyes of German origin amounted to 1,937,665 pounds, and represented 86 per cent of the total imports of dyes.

THE ACTION OF THE ALKALIES UPON WOOL

(*Continued from page* 114)

Chapin's Results

All readers of the Reporter are so familiar with the recent very valuable paper of Dr. H. C. Chapin, American Dyestuff Reporter 16, 89-94 (1927), along the same line as the above, and it is so readily available, that only the summary will be given in Table LX-A. This work shows that the action of the potassium compounds upon the wool fiber is identical with that of the corresponding sodium compound, in equimolecular proportions; and that soap appears to exert some protective action on the wool against the alkaline solution. All readers of the present review should refer to Dr. Chapin's original papers for complete details of this valuable work.

TABLE LX-A

Summary of the Effects of Water, Soap, Alkalies and Alkalies with Soap, Upon Wool Yarn at 47° and 53° C.

	Strength in grams
Average strength of skeins soaked in water at room temperature	194.0
Average strength of skeins soaked in water at 47° or 53° C. (117° or 127° F.)	177.0
Average strength of skeins soaked in an aqueous 0.5 to 1.0% sodium olive oil soap solution at 47° or 53° C. for 3 hours	169.0
Average strength of skeins after soaking in sodium or potassium carbonate solutions (0.1 to 0.4 normal) for 3 hours at 47° C.	145.0
Average strength of skeins after soaking in sodium or potassium carbonate solutions (0.1 to 0.4 normal) for 3 hours at 53° C.	134.0
Average strength of skeins after soaking in the carbonate solutions, *plus soap*, for 3 hours at 47° C.	153.5
Average strength of skeins after soaking in the carbonate solutions, *plus soap*, for 3 hours at 53° C.	139.5
Average strength of skeins after soaking in 0.1 normal sodium or potassium carbonate solution for 3 hours at 47° and 53° C., with and without soap	151.0
Average strength of skeins after soaking in 0.2 normal sodium or potassium carbonate solution for 3 hours at 47° and 53° C., with and without soap	142.0
Average strength of skeins after soaking in 0.4 normal sodium or potassium carbonate solution for 3 hours at 47° and 53° C., with and without soap	135.0
Average strength of skeins after soaking in sodium carbonate (0.1 to 0.4 normal) solution alone for 3 hours at 47° and 53° C.	139.5
Average strength of skeins after soaking in potassium carbonate (0.1 to 0.4 normal) solution alone for 3 hours at 47° and 53° C.	139.5
Average strength of skeins after soaking in sodium carbonate solution, in the presence of soap for 3 hours at 47° and 53° C.	146.0
Average strength of skeins after soaking in potassium carbonate solution, in the presence of soap, for 3 hours at 47° and 53° C.	147.0

(*This is the first of four articles by Professor Mullin on "Alkalies on Wool." The second will appear in an early issue.*)

CAPITAL OF BRITISH CHEMICAL COMBINATION INCREASED

For Acquisition of Smaller Firms.

Further details have been received by the Chemical Division of the Department of Commerce relative to the increase in the preference shares of Imperial Chemical Industries, Ltd., recently reported in these columns.

The authorized increase in preference capital, it is stated, amounting to some £270,000, will be used in completing the financial details of the transactions entered into by the I. C. I. in acquiring control of several smaller firms. Among these the following are named: Union Acid Company, Ltd., Cassel Cyanide Company, Ltd., Oliver Wilkins & Co., Ltd., and Casebourne & Co., Ltd., all of which have already been taken over by the I. C. I.

It has been reported that two other companies in which the I. C. I. might take a financial interest are the British Alizarine Company, Ltd., and the Mond Nickel Company, Ltd. No confirmation has been forthcoming of these reports, but it seems logical that the I. C. I. might desire control of the alizarine company, and there is apparently some probability that the company may be taken over. Reports regarding the Mond Nickel Company are rather more indefinite, and, while there is, of course, a close family connection between this company and the I. C. I., it is not entirely certain that any financial control will be acquired immediately by the chemical group.

The fight against tuberculosis, even with notable success to its credit, never for a day is allowed to subside into mere routine publicity. The latest campaign carries as its slogan, "Let Your Doctor Decide." This message will be flashed from billboards and posters from coast to coast, according to the plans of the National Tuberculosis Association, which is terming this latest effort an "Early Diagnosis" campaign.

The purpose of the campaign will be to persuade people to consult their physicians at the first sign of such symptoms as: Too Easily Tired, Loss of Weight, Indigestion, and Cough that Hangs On, all of which will be listed in the campaign messages.

Technical Notes from Foreign Sources

Application of Chromium Compounds in Dyeing

The most important of the chromium compounds from the standpoint of the textile industry are sodium dichromate and potassium dichromate. Chrome alum, chromium fluoride, chromium acetate, chromium chloride and chromium bisulphite are also used. Chromium acetate is used to some extent in the dyeing of silk and wool, but it is an important salt in the printing of cotton and woolen goods. Chrome alum is used in mordanting wool. Chromium fluoride is used in mordanting wool, for afterchroming alizarine and certain substantive colors on wool, and also for afterchroming substantive colors on cotton to increase their fastness to washing. It is used in place of chromium acetate in calico printing. Chromium bisulphite is well adapted for mordanting piece goods. Chromium chloride can be used to mordant cotton in two ways. The cotton may be impregnated with the mordant, dried and passed through a hot solution of sodium carbonate. The second method involves the use of tannic or oleic acids.

The character of the dyestuff must be taken into consideration in chrome mordanting. Thus better results are obtained with certain colors on a reduced mordant rather than on a "sweet" one or one of chrome and vitriol, which are oxidizing in action. In mordanting wool with chrome it is necessary for the wool to be clean. No grease or soap should be left in the fiber, otherwise dull shades will result. The method of applying the chrome mordant to the goods varies with the opinion of the individual dyer.

Various methods of applying the mordant are described in the original article. Even mordanting is, of course, essential. Some of the causes of unevenness are too rapid boiling, water content of the bath too low, and poor washing off. It is advisable to mordant the wool at a gentle simmer and in a water content sufficient to allow of free circulation. Chrome mordanted goods, with or without an acid assistant, are yellow in color, and under the influence of actinic rays of light this yellow color is gradually changed to green. Goods that have been allowed to become affected in this manner will very likely dye unevenly. Goods which are suspected of having been thus affected should be passed through a bath of sodium bisulphite solution before dyeing, which will probably remedy the fault.

It is possible to overchrome wool, especially when intended for a Logwood Black or Blue. If this is excessive and logwood is dyed thereon, only a dirty brownish shade will result, the reason for this being that the excessive mordant in an oxidizing state attacks the coloring principle in the logwood and destroys the same by oxidation. The fault of overchroming can be adjusted, if found out in time, by passing the goods through a fresh bath of some reducing agent —for example, sodium bisulphite or tartar. If this procedure is not desired, one may first dye with a small percentage of Alizarine Blue, which robs the mordant of its aggressiveness, and then the logwood can be applied.

Whatever chroming process is used, the proper amount of chrome for a batch may be added all at once to the bath, but care should be taken that increase in temperature is gradual, as the deposit of the chromium oxide on the fibers is effected during the gradual increase, as also during the subsequent boiling.

The toxicity of chromium compounds is an important matter to those that handle them. Careless handling of bichromate will give rise to "chrome sores." Means of preventing chrome sores are to be found in providing the men with rubber gloves, or before handling the compounds the men should smear their hands and arms with some protective ointment, such as a mixture of vasciline and lanolin. (The Textile Manufacturer, 1927, pages 356-358.)

Determination and Importance of Solubility of Rayon in Alkali

Maximum solubility of cellulose in alkali liquors exists at a concentration of 10% sodium hydroxide, and important differences in the chemical characteristics of the various types of rayon can be detected by exhaustive treatment with sodium hydroxide, preferably at 9% concentration. Half a gram of chopped rayon is treated in a glass-stoppered flask with 30 c.c. of the sodium hydroxide solution for about three hours at a temperature of 18° to 19° C. The liquor is filtered off through a Schott glass filter crucible, and the residue is pressed hard. The latter is stirred up again with 10 c.c. of fresh sodium hydroxide, allowed to remain for fifteen minutes and again sucked dry. It is then washed and dried at a temperature of 110° to 115° C.

The maximum solubility is found in all cases with 10% sodium hydroxide, but 9% affords a more highly differentiated characterization of the various types. Cuprammonium rayon is the most resistant, with a maximum solubility of 30%, viscose 40% to 50%, while nitro rayon is almost completely soluble in 10% sodium hydroxide. Finer differentiations between rayons of the same type may be made by performing the extraction with sodium hydroxide of different con-

centrations in the neighborhood of 10%. The size of the individual filament has an influence on the result, and particular attention must be paid to the temperature. (Papier Fabrikant, 1927, Vol. 25, Fest und Ausland Heft, pp. 66 to 71.)

Singeing Yarns

A machine which is used for singeing yarns is patented in British Patent No. 275,253 and is shown in the accompanying illustration. The machine comprises a compressed air conduit 3 (Fig. 2), which supplies the pipe 3a of a jet 1 (Fig. 3), and a fuel conduit 4, which supplies an outer pipe 4a. Suction apparatus opposite these jets comprises a suction conduit 10, which has a suction element 6 provided with orifices 6a, and which is connected to a smoke and dust collecting conduit 11. The yarn is led over a guide 42, through a

FIG.2.

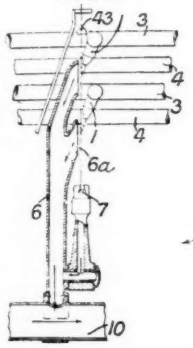
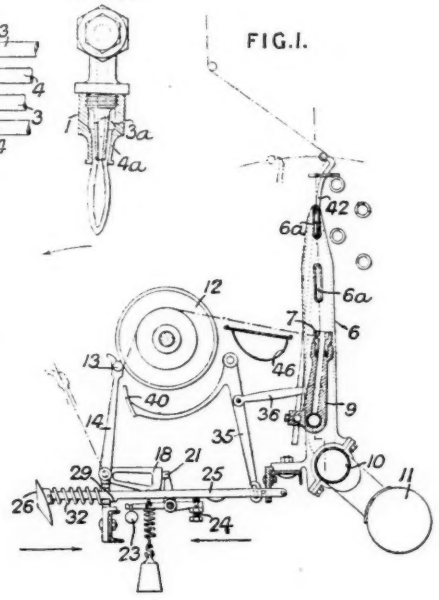


FIG.3.

FIG.1.

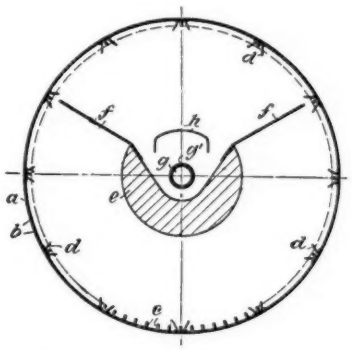


notch 43, around a support 7 and over a split drum 12 to a spindle 13, on which it is wound. Means operating automatically or by the knee of the operator to stop the winding and throw the yarn clear of the jets are provided. The lifting of the rod 25 by the knee of the operator engaging the plate 26 thereon releases a catch 29, a spring 32 moves the rod forward and, acting through an arm 35, causes a plate 40 to push the spindle 13 clear of the drum 12 and at the same time a link 36 swings the yarn support 9 on its pivot to throw the yarn clear of the jets.

When the spindle 13 is fully wound, the arm 14 occupies the position shown in dotted lines in Fig. 1. In this position a sector 18 secured to the arm 14 is raised clear of a tapper 21, which falls under the action of a weight 23, stopping the reel and causing a screw 24 to lift the rod 25 and so throw the yarn clear of the jets. The yarn support 9 carries guides 42 and 7. A current of fresh air from a conduit 46 is provided between the operator and the jets.

New Type of Steaming Cylinder

A new hot-pressing or steaming cylinder, patented in German Patent No. 447,253, makes certain that the operation is properly carried out without the formation of water spots and without the necessity of providing cylinder packing. This action is secured by providing the cylinder jacket with stationary nozzles



a and also with grooves d. The grooves or channels carry the condensate in a constant upward direction while the cylinder is being rotated. The apparatus is shown in cross-sectional view in the accompanying figure.

The cylinder jacket a is made in the usual manner and is provided with a series of openings in which the small tubes c are placed. These are the stationary nozzles. The channels d for the removal of the condensate are arranged between the series of tubes c. A run-off channel is arranged within the center of the cylinder. This is provided with the conducting plates f which carry the condensate to the run-off channel. The tube g in the center of the cylinder is for the purpose of conducting steam into it. It is provided with openings g' at its top so that the steam is made to come into contact with the plate h and equal distribution of the heating effect is secured in this manner. All the water of condensation which does not collect in the channels f and flow into the outlet e collects in the bottom of the cylinder and is then constantly removed through the channels d.

Indanthrene Blue Reserve and Manganese Reserve

Manganese and zinc salts, when printed on the fabric with the aid of suitable thickeners and then dried, act as reserves against vat liquors in the same well-known manner as salts of other heavy metals. What happens is that these salts reduce the solubility and the welling power of the thickener, or, in other words, harden it. Furthermore, these metallic salts neutralize the alkali in the liquor which first comes into contact with the reserve, and finally they form more or

less alkali-soluble hydroxides in finely dispersed form; but nevertheless, in such form that these hydroxides are deeply imbedded in the thickener and distributed throughout its mass. The alkali-solubility of manganese hydroxide and its tendency to form complex molecular structures of higher degrees of oxidation appears to be particularly well suited for this purpose.

The reserving action of the salts of the heavy metals in general is, as is known, very considerably enhanced by the presence of oxidizing agents which also have a reserve action. The action of manganese dioxide as a reserve cannot, however, be interpreted in this sense. It is much more proper to compare it with the known reserve action of any indifferent or insoluble filler. Manganese dioxide acts at times in such a manner that due to its adsorbing action on the dyestuff it forces the latter to take a part in the reserve process.

Manganese dioxide is easily formed in the reserve under the oxidizing action of the chromates which are present and then in proportion to the amount of the latter present in the mixture, it forms complex compounds of different but constant composition. Nevertheless this oxidation process never runs along to completion in one direction, even when the slightest amount of chromates is present in the mixture, but an equilibrium sets in at all times, so that besides chromium sesquioxide, chromium trioxide is always present in the reserve, part of it being found in the aforementioned complex compounds and part, however, in the form of soluble chromates.

Only chromium trioxide acts exclusively as a reserve which is due to its oxidizing properties.

On the other hand, in certain organic nitro compounds, such as Ludigol and the like, which can likewise have a reserve action only for the reason that they are oxidizing in character, are found reserves which do not show certain less convenient by-reactions which are common with chromium trioxide. When these products are used, it is possible to avoid adding any inorganic salt whatsoever to the reserve composition. (Melliand's Textilberichte, 1927, pp. 861-864.)

Hydron Blue and Its Resistance to Chlorine

The Hydron Blues combine in them the properties of sulphur and vat dyestuffs. Their most important property is said to be resistance to chlorine. They are also fast to rubbing. They do, however, lose their brilliancy on repeated washing and assume a grayish tone. It has been found in practice, however, that the color is very markedly decreased in depth by the action of bleach liquors. A dark blue is thus converted into a blue of moderate depth, and the brilliancy of the color is impaired. Bleaching with chloride of lime has the most potent effect on the color, while sodium hypochlorite solution does not appear to have so powerful an action. Sodium peroxide bleach does not have to be considered, for it is an expensive reagent and Hydron Blues are used only in dyeing cheap goods.

The method of dyeing and also of after-treating the goods are therefore of considerable importance. Dyed fabrics that are after-treated with sodium perborate or chromic acid will be more resistant to the action of the bleach liquor than when the dyeing operation is carried out in a boiling hot soap bath. This is particularly true of machine dyeing. Only the soaped and not after-treated Hydron Blue dyeings, when bleached in the jigger, have a tendency to run in the second boiling-off process, a phenomenon which appeared at the time to be wholly contradictory of all the claims for fastness made for the Hydron colors. The cause of this trouble must be looked for in the dyeing process itself. The fabrics were dyed in a special apparatus, sucked dry three times under a vacuum, thoroughly washed and then soaped in a boiling hot soap liquor. There was certainly nothing wrong with such a process and nevertheless the resistance of the dyed fabric to bleach liquor was poor. It was clear that this resistance was not the same as that obtained when the process was carried out with the aid of perborate or potassium chromate and acetic acid. It therefore follows that the oxidation effected by suction and washing is not complete enough. The subsequent soaping interrupts the oxidation and only a slight fastness to chlorine is the result. The use of oxidizing agent, however, makes certain that the oxidizing effect is complete. It is therefore recommended that this method always be used when the color must stand up against the action of chlorine bleach liquors.

All the Hydron Blue dyed goods change on bleaching and the color becomes more or less greenish, and in order to bring back the shade to its original state it is essential to treat the goods in a liquid containing 15 grams of sodium hydrosulphite to 100 liters of water. This has the advantage, however, that the white designs on the fabric will be affected by the Hydron Blue on the rest of the fabric, although the color is only slightly reduced. Such an effect has been particularly remarked in the case where the goods are treated in the jigger. The danger of the color running is avoided by dyeing without stretching the fabric.

In conclusion it may be said that the use of Hydron Blues on goods that are afterwards to be fast to chlorine is satisfactory when the fact that the color will become lighter and that the goods will then have to be treated with sodium hydrosulphite liquor to bring it back to the original shade are taken into consideration. The manner of treating the goods is important and this refers not only to the aftertreatment but to the oxidation of the color as well. (Deutsche Faerber Zeitung, 1927, pp. 952-953.)

H. W. Stiegler is engaged in research at the laboratories of the Cheney Brothers Silk Company, South Manchester, Conn. Dr. Stiegler was formerly connected with the chemical department of the Lowell Textile School.

SIAM DYE TRADE WORTH FIGHTING FOR

Before the war the dye trade of Siam was under the thumb of the German monopoly, as were most of the other dye markets in the world. During 1919, however, says a report from the Chemical Division of the Department of Commerce, the Siamese dyers favored American colors, their supplies of all other kinds being virtually cut off. Since Germany resumed its position as a dye-producing nation the dyes of American manufacturers have been waging a losing fight for a share of the market.

From the statistics of dye imports, the Siam market would seem to be worth the winning. During 1926, the latest year for which figures are available, Siam imported 324,000 pounds of colors, and as the poundage has been increasing steadily over the past five years it is not unreasonable to assume that the imports for last year were considerably larger.

The Siamese are fond of bright colors, the best selling dyes being violets, dark greens, magentas and scarlets; pink, blue, light green, orange and yellow are also in demand. Lack of representation and exploitation on the part of American manufacturers seems to be the main reason for their small share in this trade.

ABSTRACTS OF JAPANESE CHEMICAL LITERATURE ISSUED

Researches Traced Back to 1877

Responding to a demand from numerous workers in the field of chemical science in Japan, Prof. R. Maima of the Tohoku Imperial University recently entered upon the task of making complete abstracts of all literature covering chemical research in Japan, which will involve a study of the literature issued as long ago as 1877.

Abstracts of papers published between 1877 and 1926 will be published in bound volumes, completely indexed. Abstracts of more recent chemical literature—for the year 1927 and for future years—is now being published monthly in journal form.

CUBAN MARKET FOR DYESTUFFS AND COAL TAR PRODUCTS

Cuba takes fifth place in the United States' world chemical export trade. The principal Cuban dyestuff demand is for package dyes and dye soaps used in the home, the annual requirement reaching approximately $100,000. Commercially, the important demand for dyes is for cleaning and dyeing establishments, the largest single enterprise, consuming annually about $10,000 worth. Chief competition in the Cuban dyestuffs market is between American, French and Spanish manufacturers.

RECENT LITERATURE

Textilchemische Erfindungen, Lieferung 1. Dr. Adolf Lehne. A. Ziemsen Verlag, Wittenberg (Bez. Halle).

This work is the first part issued of a periodical digest of German patents relating to the whole field of textile chemistry: dyeing, bleaching, finishing, mercerization, washing, the chemical synthesis of synthetic fibers, carbonization and new dyestuffs. The present volume (of 100 octave pages) covers all German patents on these subjects from July 1, 1926, to June 30, 1927. It is proposed to issue subsequent volumes hereafter half-yearly.

To one familiar with the bulky (but all too small!) volumes of Friedlaender's Fortschritte, the present volume seems almost tiny. But the reviewer is of the opinion that such works as these should be either very ample, indeed, or carefully compressed. The present work is written from the second standpoint, and is, as it professes to be, an abstract of the patents coming within its scope. Dr. Lehne being the redactor, the accuracy and clearness of the abstracts, which vary in length from a few lines to nearly a page, may be depended upon with confidence.

With Friedlaender's work in mind, the reviewer at first rather regretted that at least the full text of the patents was not included; but on more deliberate consideration decided that, as a guide to the literature covered, the scheme of the present volume is probably in the most convenient and useful form possible. If one wishes to consult the original patent in a given case, that can, of course, be done. But the present digest makes it possible for one to decide whether it is necessary to go to that trouble. It appears to us to be both valuable in principle and well done in execution; and we could wish only that Dr. Lehne might see his way clear to extending it, in subsequent issues, to cover the patents from other countries as well.

F. S. B.

A Study in Soap

Castile Soap—A Monograph Covering the Origin, History and Significance of the Term. By R. W. Mitchell, Ph.D. 188 pages.

The other half of the title of this monograph indicates more clearly its contents: "Together with a discussion of the properties, uses, reputation, adulteration and imitation of the product based upon over 900 extracts from the literature of 400 years."

The booklet is evidently the work of one of those

patient, scholarly bibliographists who trace through thousands of volumes in many languages every minutest reference to whatever specific subject they select for study. Prodigious labor must have gone into the preparation of this book, yet it would seem to be of slight technical importance mainly because its text is largely of historical interest. The author undertakes to answer the question, "What Is Castile Soap?" by quoting opinions and references from countless medical, pharmaceutical and chemical dictionaries, books on the care of infants, Congressional reports and voluminous trade journal literature.

Dry-Cleaning Fur and Leather

Cleaning of Fur and Leather Garments. By M. H. Goldman and C. C. Hubbard. Technologic Papers of the Bureau of Standards No. 360.

The increasing use of fur and leather garments has made the necessity for adequate methods for their cleaning more urgent. Dry-cleaning plants, to quote from an introductory abstract to this monograph, have been handling a large proportion of these materials either directly or on a wholesale basis for furriers and cold-storage establishments. A study was made to establish a method for thoroughly cleaning the garments, yet retaining the "fat-liquor" content, which is essential to the appearance and pliability of the material.

It was found that by modifying the usual dry-cleaning process by the addition of small percentages of paraffin this result could be accomplished. Samples cleaned showed no loss of color, had good appearance and retained their pliability. Trials in cleaning plants of preliminary recommendations permitted the fixing of standard practices.

ON TRIAL FOR SPYING IN GERMAN DYE FACTORIES

Charged with commercial espionage, Guido Meisel, an American chemist of Portsmouth, N. H., was put on trial last week in Dusseldorf, Germany. He is accused of having sought to obtain chemical formulas for the treatment of rubber. On the request of those who are prosecuting him, the trial is being held behind closed doors to prevent important dye secrets from being revealed, according to an Associated Press dispatch. Representatives of the German dye industry are said to have declared in the course of the hearings that a secret court session was necessary, as they would be obliged to bare methods adopted by the German trust to ward off foreign espionage.

The National Research Council, Washington, D. C., has issued as Bulletin 80 a list of "Doctorates Conferred in the Sciences by American Universities, 1926-1927." Copies of the bulletin may be obtained from the Council for fifty cents.

JOHN SOKOLINSKI SPEAKS AT CLEMSON COLLEGE

On the Application of Sizes and Finishes

John J. Sokolinski, of the Arabol Manufacturing Company, of New York, lectured to the students of the Textile School of Clemson College upon "Sizes and Finishes and Their Application" on February 13.

Mr. Sokolinski has had a very wide experience both in the manufacture and analysis of these products, as well as their applications in the textile and related industries, and is therefore especially qualified to speak upon a subject on which so little reliable information appears in the literature. An animated discussion of the subject in which most of the faculty participated, added considerably to the value of the interest in the program.

NEWPORT ANNOUNCES SEVEN NEW COLORS

Dyeings of seven new products are displayed on leaflets issued by the Newport Chemical Works last week. The leaflets, besides containing swatch bows showing the application of the colors, describe their fastness properties and other features. The new colors are: Anthrene Blue RCX Paste, Newport Acid Anthraquinone Green G, Newport Fast Acid Blue SB, Newport Direct Fast Red FCB, Newport Sulphur Blue M, Newport Sulphur Blue DRG and Newport Sulphur Brown CTG Conc.

Anthracene Blue RCX Paste is described as a bright greenish blue of excellent general fastness, its most important characteristic being its fastness to chlorine. It is suitable for dyeing cotton in various stages of manufacture in all types of machines. Rayon is also dyed excellently by this color, according to the announcement. It does not discharge nor print well.

Described as a very valuable color for dyeing wool in all stages of manufacture, Newport Acid Anthraquinone Green G, it is claimed, possesses excellent general fastness combined with good level dyeing properties. It is of special interest in the dyeing of high-grade woolen and worsted goods, knitting and sweater yarns, bathing suit material, etc.

The third color, Newport Fast Acid Blue SB, is said to be of value in the dyeing of bright blues on woolen and worsted fabrics, yarns, etc., but is also of particular interest for silk white goods, since effect threads of silk, rayon and cotton are left unstained. Excellent general fastness properties are attributed to it, among which special mention is made of its resistance to light, rubbing, steaming and perspiration.

The Direct Fast Red FCB can be applied to rayon and silk, either pure or tinweighted. In dyeing union materials of cotton and wool or cotton-silk, the animal fibers are dyed somewhat stronger at the boil. Its good general fastness properties, according to the de-

scription, recommend it for dyeing cotton in all stages of manufacture.

Newport Sulphur Blue M is a direct dyeing product described as having excellent general fastness qualities, good solubility and leveling and penetrating properties. It is adapted for machine dyeing of cotton in all stages of manufacture, but also produces navy shades on rayon.

Described as a greenish shade of blue of special interest in dyeing of sky blue shades, Newport Sulphur Blue DRG is also claimed to possess good fastness to light, washing and cross dyeing. Its fastness to both steaming and perspiration is said to be excellent.

The new Sulphur Brown CTG Conc. also finds extensive use for the dyeing of cotton in all stages of manufacture in all types of machines. It is also adapted for the dyeing of rayon, and is further described as readily soluble, leveling well and having very good all-around fastness properties.

MILLS AND MEN

Otto R. Hartmann, former overseer of finishing at the Rochdale (Mass.) Mills of the American Woolen Company, has accepted a similar position with the Pacific Mills, Lawrence, Mass.

George L. Gilmore, proprietor of the Middlesex Bleach, Dye & Print Works, Somerville, Mass., and president of the Textile Research Council, and Mrs. Gilmore are spending a vacation of some three months in Hawaii.

The Textile Square Club recently held its eighth regular meeting at the Arkwright Club. This was observed as a special guest night.

F. T. Mason, a graduate of the University of North Carolina, has accepted a place with the Eagle & Phoenix Mills, at Columbia, Ga., as dye specialist.

The new rayon converting mill to be established in Spartanburg will occupy a seven-acre tract on Williams Street at the Piedmont and Northern Railway right-of-way and will be housed in three one-story buildings, covering 50,000 square feet, according to plans announced. The cost will be $300,000. One of the buildings will hold the converting plant, another the cloth knitting machines and the third a dyeing finishing layout. The payroll will amount to approximately $5,000 a week.

John H. Orr, president and secretary of the Worcester (Mass.) Bleach & Dye Works Company, has been elected a member of the board of managers of the Employers' Association of Central Massachusetts.

C. B. Williams, formerly of Hope Mills, has been appointed superintendent of the new sash cord plant of W. H. Draper & Co., Rocky Mount, N. C.

The Gossett Dyeing & Finishing Company, Anderson, S. C., is now in operation. Although a separate corporation, this plant will be operated in conjunction with the other Gossett mills in Anderson.

The Mayon Converting Company, Inc., just organized at Salisbury, N. C., will operate as converters of rayon and cotton textiles. The organizers are E. B. Marsh, F. B. Marsh and M. E. Marsh.

Leroy Erskine, an assistant superintendent of the cotton department of the Amoskeag Manufacturing Company, Manchester, N. H., has been assigned to the district south of Bridge Street.

Henry Wheeler, Jr., assistant superintendent of the cotton division of the Amoskeag Manufacturing Company, Manchester, N. H., has been transferred to the worsted department to succeed William F. Mudge, who resigned recently.

William J. Hale, director of organic research of the Dow Chemical Company, and past chairman of the Division of Chemistry and Chemical Technology of the National Research Council, has been appointed chairman of a committee of the division to foster co-operative researches between industries and academic institutions. This co-operative plan was instituted by Doctor Hale while he was chairman of the division.

The Gaede Silk Dyeing Company, Paterson, N. J., has taken out a permit for a one-story dye house on River Street.

The National Yarn & Processing Company, of Chattanooga, Tenn., will enter the rayon bleaching and dyeing field, according to announcement by T. H. McKinney, president. The executive announced awarding of the contract for a new addition to the plant to take care of this department to Mark K. Wilson Company, well known local contracting concern. It was intimated that the develipment may lead to something more important and possibly into the establishment of a rayon plant in Chattanooga at some future date.

The Southeastern Dye & Bleachery Works, Salisbury, N. C., will establish a new dyeing, bleaching and finishing plant to cost $50,000. T. H. McKay, formerly of Providence, R. I., is head of this new industry and will be in active charge of the plant.

The Alsop Engineering Company, this city, has just published a new catalogue of Hy-Speed portable elec-

tric liquid mixers, containing valuable information for all firms interested in liquid processes. The company will be glad to send one of these catalogues to any interested person.

FOREIGN TRADE AND DOMESTIC TRUSTS DISCUSSED AT CHEMICAL TRADE MEETING IN WASHINGTON

Dr. Klein, Wm. J. Donovan and Other Commerce Department Men Address Executives at Successful Meeting.

THE meeting of chemical executives held in the United States Chamber of Commerce in Washington last Thursday, February 16, was generally declared to have been even more successful than that held last winter. The program was the fruit of close co-operation between the Chemical Advisory Committee and the Department of Commerce, and it could not have failed to impress the 400 executives of the chemical and textile industries who attended with the importance of the work being carried on by the Department in the interests of their trades.

The development of our export trade in chemical products was discussed in a general and very instructive way by Dr. Julius J. Klein, and specific export markets were reviewed by Trade Commissioner William T. Daugherty of Berlin and D. J. Reagan, assistant commercial attache of Paris. William J. Donovan, Assistant Attorney General, addressed the chemical men on the subject of foreign cartels and domestic trusts. C. C. Concannon, chief of the Chemical Division of the Department of Commerce, surveyed the present condition of the American chemical trade. Assistant Director of the Bureau of Standards Ray M. Hudson spoke on the importance of simplification in industry.

In the course of his survey of foreign markets, Dr. Klein stated that certain factors in the American industry were evidently devoting considerable study to conditions abroad, but that not only our export trade but also our methods of distribution at home call for even more intensive analysis. The chemical industry, he said in effect, was not taking full advantage of some foreign market conditions and could study with profit means of attaining more efficient distribution of their products at home.

In his address on trusts, Wm. J. Donovan frankly opposed the agitation in some quarters for anti-trust law amendments that would permit larger combinations within our industry. He declared that the setting up of any monopolies would eventually lead to Government regulation, something certainly undesirable under any conditions. Certain protective measures now existing and others proposed, he said, represent this country's challenge to the power wielded by recently formed European cartels. After pointing out that the Webb-Pomerene act had paved the way for co-operation among exporting firms, he reminded the gathering that an amendment to that act which will be introduced calls for similar rights to practice collective purchasing of raw materials in foreign markets by American manufacturers.

A. Cressy Morrison, chairman of the Chemical Advisory Committee, presided during the meeting. The conference closed with a round-table discussion of the facilities made available to industry by the Department of Commerce and of the various channels for reliable information open to the chemical industry through the services of the Chemical Division. In addition to the leading chemical manufacturers a number of textile mill executives attended.

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